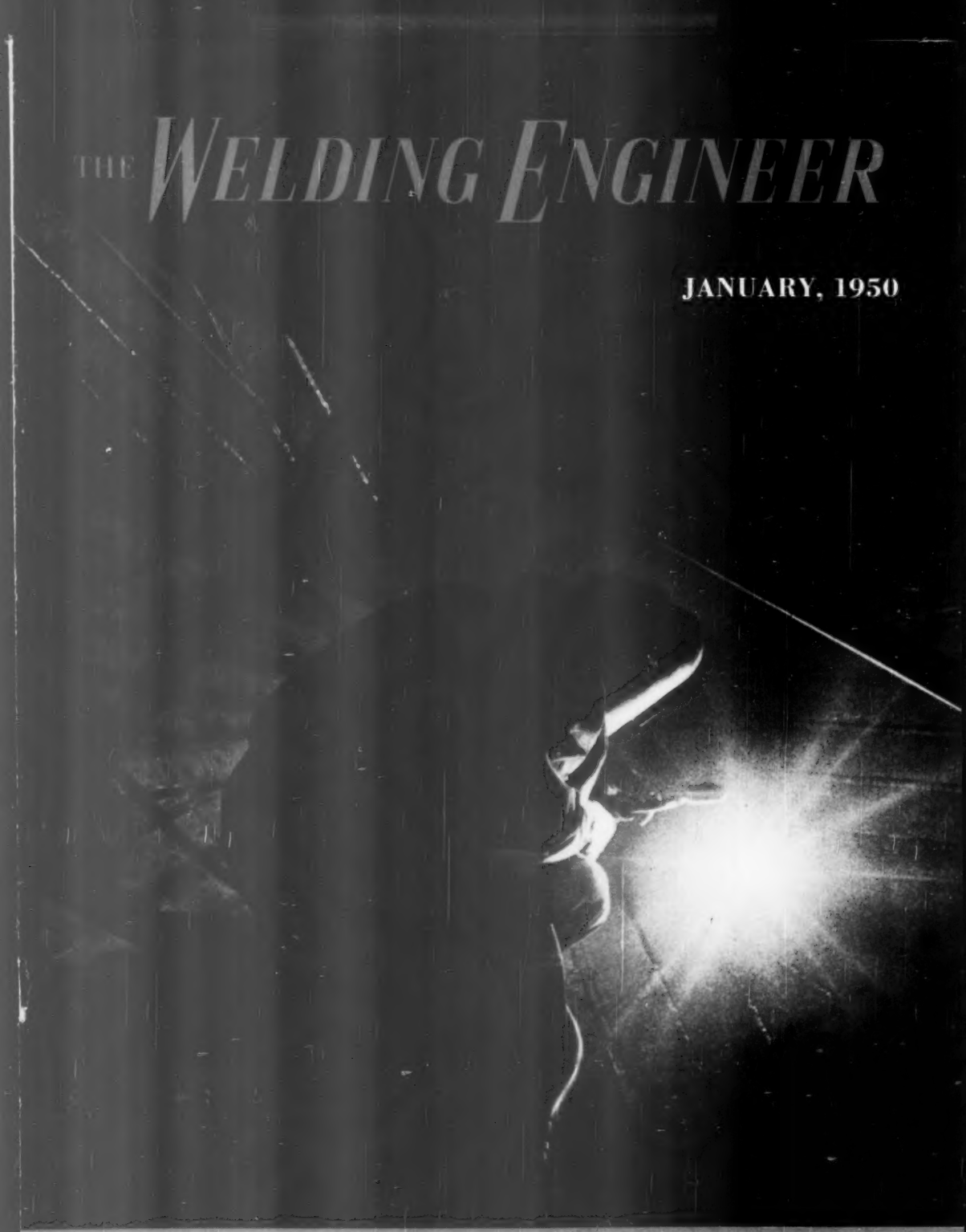
THE WELDING ENGINEER

JANUARY, 1950



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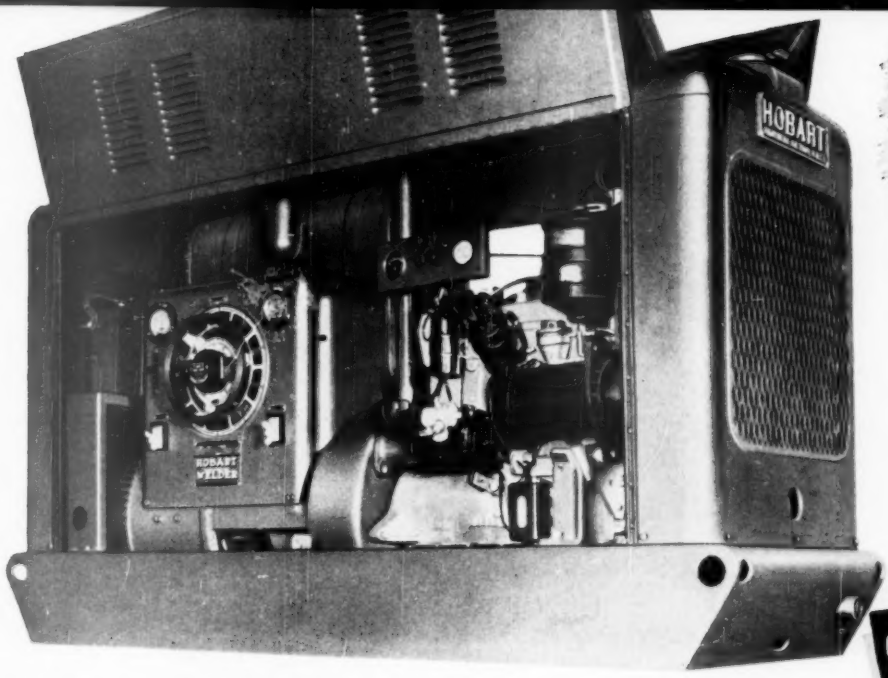
A McGRAW-HILL PUBLICATION

Tough
Extra Flexible
Easy to Use
Belden tough, extra-flexible Welding Cable is manufactured by wiremakers who have over 40 years' experience in production technique and research. The Belden Welding Cable conductor is made especially flexible with strandings of electrolytically pure copper wires. It has a tough, extruded rubber insulation. It is resistant to shock, kinking, heat, cold, or abrasion. Easy to use. When you order, specify Belden.
ask for
Belden
Welding CABLE



MORE FOR YOUR MONEY... a Hobart has more built into it, that's why you get MORE out of a Hobart

D. C. Electric Drive

A. C. Transformer Type

D. C. Generator

Choose any HOBART
Buy on HOBART'S own
EASY "PAYS FOR ITSELF" TERMS
Check the coupon for full particulars

BIGGEST VALUE in arc welders!

Portable or Stationary welders are built by HOBART in one of the largest, most complete lines available today. No matter what your welder requirements may be, you'll find it will pay you to investigate and compare before you buy.

A. C. or D. C. Welding can be done easier, faster and better than you ever thought possible. HOBART Welders have a wider welding range than any other arc welder of similar rating. Exclusive features, including Multi-Range Dual Control and Remote Control, result in more welding per day at lowest costs.

Auxiliary Power Units in combination with HOBART gas engine or belt driven welders are available in several sizes of A. C. and D. C. welder—power combinations. Check the coupon for more details on how lights, motors and tools can be operated on the job, in addition to welding, to bring you extra profit-making advantages.

Lower Welding Costs with less maintenance, longer machine life and easier operation are facts in HOBART Arc Welders—facts which can be proven beyond any question, without obligation. Mail the coupon for more details on today's biggest arc welder value.

A. C. Welder—Power Plant

A. C. Weld Pow'r Gen'r'tor only

D. C. Welder—A. C. Power Plant

Diesel Drive—Road Trailer

HOBART WELDERS

Manufactured by "One of the world's largest builders of arc welders"

Make this Welding Electrode "Discovery" for Yourself

Many users of electrodes find by running a test in their shop that HOBART Electrodes increase welding speed, reducing the cost of labor, electrodes, power, etc. Check coupon for catalog listing full range of sizes and types made for A.C. and D.C. welding.

HOBART BROTHERS COMPANY, BOX U-10, TROY, OHIO

We want more proof that HOBART is today's biggest value in arc welders of _____ amp. capacity. Also send information on items checked.

☐ D. C. Gas Engine Drive ☐ D. C. Electric Drive ☐ A. C. Transformer Type ☐ D. C. Generator Only ☐ A. C. Welder—A. C. Power ☐ D. C. Welder—A. C. Power ☐ D. C. Welder—D. C. Power ☐ A. C. - A. C. Generator Only ☐ D. C. Diesel Drive ☐ Road Trailers ☐ Electrode Catalog ☐ Accessories Catalog

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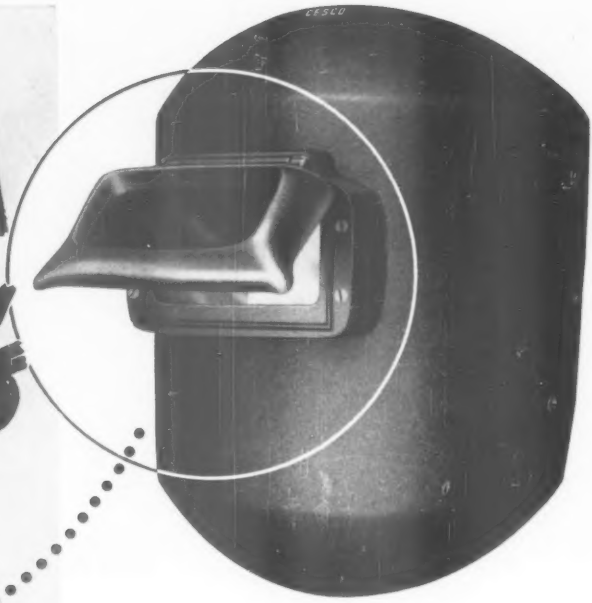
EXTRA STRONG

where it takes abuse



CESCO's 545-W welders goggle is tops in safety, comfort and durability. Perfected shaping of cups plus Comfort-King headband reduce tension on face.

PROTECT YOUR FILTER PLATES with CESCO's new plastic cover lens. Outlasts glass 100 to 1. For better visibility use CESCOWELD filter plates and lenses.

CESCO's IMPROVED LIFT-FRONT TYPE WELDING HELMET features a new, stronger-built, moulded plastic lens holder. This new lens holder, reinforced to give it the strength of metal, is impervious to heat or flame . . . a non-conductor of electricity. Streamlined to prevent slag accumulation, it has exclusive shock absorber plus soft spring action to relieve snap or jar when door is raised and lowered. The one-piece seamless shell is drawn from hard vulcanized fibre, and has adjustable chin rest and adjustable headgear with leather sweatband.

Write for catalog showing CESCO's *complete line of welding helmets* and *goggles.*

CHICAGO EYE SHIELD COMPANY
2330 Warren Blvd • Chicago 12, Illinois

CESCO FOR SAFETY

OFFICES IN: Atlanta, Birmingham, Boston, Buffalo, Cincinnati, Cleveland, Columbus, Detroit, East Orange, Houston, Los Angeles, Montreal, Philadelphia, Pittsburgh, Seattle, St. Louis, St. Paul, Toledo, Tulsa

THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

A McGRAW-HILL PUBLICATION

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IN THIS ISSUE

COVER: *Welder at the Nooter Corp., St. Louis, is attaching stainless-steel strips to the inside of a large tank head for high-temperature refinery service. Completed vessel is 8 ft ID by 57 ft long. The strips were welded together and to the shell with 25-20 austenitic electrodes.*

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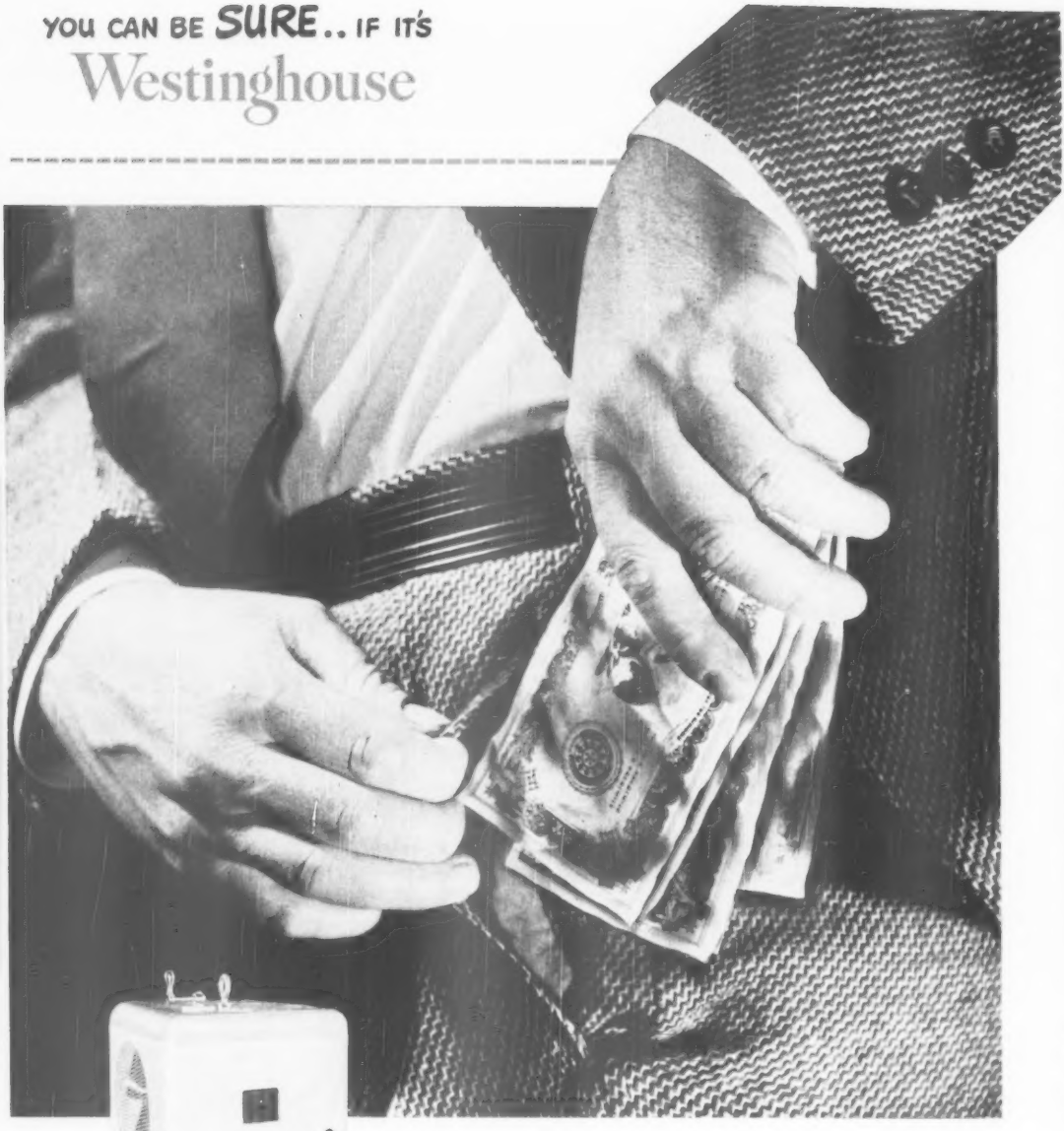
YOU CAN BE **SURE**.. IF IT'S
Westinghouse



For the first time in D-C welding history, efficiency, no-load losses, and power factor add up to real dollar savings. The NEW WESTINGHOUSE D-C WELDER replaces the bulky, noisy motor-generator with a light-weight, quiet selenium rectifier.

Pocket $126*

...EVERY YEAR!

with savings from the NEW Westinghouse D-C WELDER

Actual cost comparisons prove that the New Westinghouse D-C Welder *saves* $126 in power bills . . . per year . . . per welder. This figure is in comparison with the old-fashioned motor-generator type D-C welder (see below).

These savings . . . and others . . . are direct results of the fact that the New Westinghouse D-C Welder:

HAS NO ROTATING POWER PARTS. Selenium Rectifier replaces old-fashioned motor-generator. Saves maintenance. Saves weight. Saves space.

LOW NO-LOAD LOSS. No-load loss of this new D-C welder is ONLY 500 watts as compared to 2,480 to 3,600 watts for a motor-generator welder.

EFFICIENCY INCREASES AT REDUCED LOAD, where most welding is done. At 20 percent rated load, efficiency of the new D-C welder reaches 73 percent as compared to 45 percent for motor-generator set.

. . . and built-in performance features that please your operators! This remarkable new welder is *really* quiet . . . instantaneous speed of response and smoothest arc make welding easy . . . arc blow is considerably reduced.

J-21541

*

	WELDING POWER COSTS		NO-LOAD POWER COSTS	
MOTOR GENERATOR WELDER	(2.66 hr/day) (300a) (40v) (260 days/yr.) (.02 $/kwh) / (.54 eff.) x 1000 va/kw	+	(5.34 hr/day) (3.04kw) (260 day/yr.) (.02 $/kwh)	= $391.79
NEW WESTINGHOUSE D-C WELDER	(2.66 hr/day) (300a) (40v) (260 days/yr.) (.02 $/kwh) / (.66 eff.) x 1000 va/kw	+	(5.34 hr/day) (.5kw) (260 day/yr.) (.02 $/kwh)	= $265.38

COST OF POWER SAVED = $126.41

Figures based on: 33⅓% Duty Cycle — 8 hour day — 5 day week — average M. G. no-load loss. Power cost $.02 kw hr.

Westinghouse
WELDING

Westinghouse Electric Corporation
Dept. DC
P. O. Box 868, Pittsburgh 30, Pa.

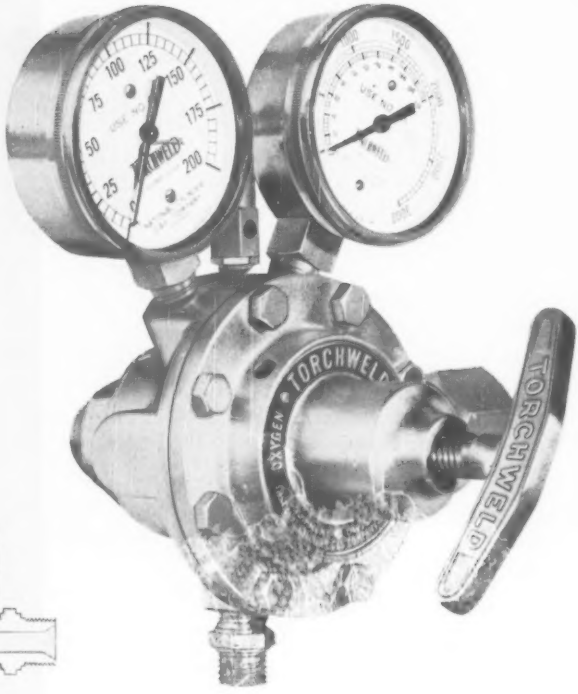
( ) I want complete facts and figures about the New D-C Welder.
( ) I want an actual demonstration of the New D-C Welder.

Name _____

Company _____

Address _____

Biggest News



Here's why Torchweld "6500" delivers constant pressure and volume regardless of cylinder pressure

In any regulator the pressure of the incoming gas is one of the forces operating the valve mechanism. As cylinder pressure drops, this force decreases, causing a variation in the volume of gas flowing through the valve.

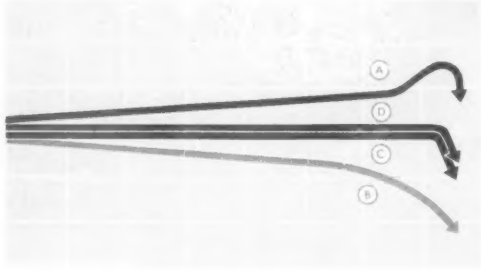
In the TORCHWELD "6500", a pressure compensating chamber below the seat counteracts the effect of this decreasing force.

A small passage in the valve seat permits gas *at cylinder pressure* to enter the chamber. At the bottom of the chamber is a reinforced rubber sealing disk. Below the disk is a pin which rests against the back of the regulator.

The forces within the chamber act upon the disk and pin so that there is a resultant effective force which tends to move the seat upward toward the nozzle.

As cylinder pressure drops this upward force diminishes, resulting in a gradual increase of the spacing between seat and nozzle. This compensates for the effects of decreasing cylinder pressures, and thus maintains constant delivery pressure and volume.

Here's how various types of regulators act as cylinder pressure drops



TYPE A—*Stem-type* single-stage regulator delivers at *increasingly higher* pressures as the cylinder empties. Frequent pressure adjustments are necessary.

TYPE B—*Nozzle-type* single-stage regulator delivers gas at pressures that *drop lower and lower* as the cylinder empties. Frequent pressure adjustments are necessary.

TYPE C—*Two-Stage* regulator gives uniform working pressure regardless of cylinder pressure, depending upon quality of regulator. Pressure adjustments are avoided.

TYPE D—TORCHWELD "6500" REGULATOR delivers constant working pressure (whatever it's set for) regardless of drop in cylinder pressure. No adjustments are necessary while welding or cutting.

in Regulators in 20 Years!

THE NEW

TORCHWELD "6500"

REGULATOR WITH PRESSURE COMPENSATING CHAMBER

NOW...the precise pressure control of the two-stage regulator for single-stage regulator cost...

Until now, whenever you bought a regulator you had to make a choice between two types—a single-stage regulator or a two-stage regulator—each with characteristic advantages.

Now, thanks to NCG research and design, you can get a regulator that combines the *best features* of *both* types, and the disadvantages of neither. The new, unique TORCHWELD "6500" offers you precise and *constant* delivery pressure and volume (at whatever setting you choose) *regardless of drop in cylinder pressure.*

Heretofore this time-saving characteristic could be had only in higher-priced two-stage regulators. Now, in the TORCHWELD "6500" it may be had for a price only slightly more than the average single-stage regulator—and you get, *in addition*, the *economy advantages* of a single-stage regulator.

It's all due to the NCG-engineered "*pressure compensating chamber*"—an exclusive, patented TORCHWELD feature that marks the first major advance in regulator design in 20 years. Further, all other features typical of TORCHWELD quality are retained—extra rugged construction, big streamlined gas passages for ample volume, the exclusive "SPIREX" nozzle element that prevents seat ignition, inlet filter, relief valve and few working parts to wear or repair.

Yes, the TORCHWELD "6500" is the greatest regulator value ever offered. Write for Illustrated Bulletin No. NTW-104 containing full details.

NATIONAL CYLINDER GAS COMPANY
Executive Offices:
840 N. Michigan Avenue, Chicago 11, Illinois

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NCG
EVERYTHING FOR WELDING

CLIP AND MAIL THIS COUPON TODAY

NATIONAL CYLINDER GAS COMPANY
840 N. Michigan Ave., Chicago 11, Ill.

Please send me a copy of Bulletin NTW-104 containing full particulars on the sensational new TORCHWELD "6500" regulator.

NAME POSITION

COMPANY

STREET ADDRESS

CITY ZONE STATE

ARC-WELDING FREE

FIRST sample our improved Class E-6010 electrode

G.E.'s NEW W-22 ELECTRODE (AWS Class E6010) is a reverse polarity d-c rod that produces high-quality welds in *all* positions. Its steady, spray-type arc is easily controlled . . . with little spatter, and excellent penetration.

This electrode is ideal for vertical and overhead welding jobs where welds of excellent appearance, high tensile strength, high ductility, and good impact resistance are particularly important.

The new W-22 has already proved itself in production tests . . . such as that at the Vulcan Steel Tank Company at Tulsa, where it was used in welding tank heads or end covers 36" in diameter and ¼" thick. Note the good fusion and excellent appearance of the finished welds. Their Welding Superintendent reports this electrode has the most forceful yet easily controlled arc he has ever seen.

You can put your confidence in

GENERAL ELECTRIC

712-2

ELECTRODES

combination offer

SECOND ...new G-E welding electrode comparator

Here's all the electrode comparison information heretofore available only on large, unwieldy charts—condensed into a handy, pocket-sized slide-rule. Naturally, it includes all G-E electrodes—mild-steel, special alloys, low-hydrogen, stainless-steel, hard-surfacing, etc.; and it covers the standard electrodes of all principal manufacturers—all suitably keyed to AWS classification numbers. And it's easy to use . . . just set the rule, and read off the comparison data directly. You'll find it the handiest means of comparing electrodes you've ever come across.

Clip the coupon for your free copy of the new G-E welding electrode "Comparator."

And here's a special bonus! Mail the coupon today, and we'll also send you a copy of the brand new edition of the pocket-sized G-E Arc-welding Electrode Catalog!

ARC WELDERS
ELECTRODES
ACCESSORIES • RENEWAL PARTS

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MAIL TO YOUR G-E WELDING DISTRIBUTOR

. . . or to Sect. G712-2, Apparatus Department, General Electric Co., Schenectady 5, N. Y.

Send me the following:

( ) Free sample of W-22 electrodes

( ) Welding Electrode Comparator slide rule

. . . and a copy of new electrode catalog, GEC-482

Name _____

Company _____

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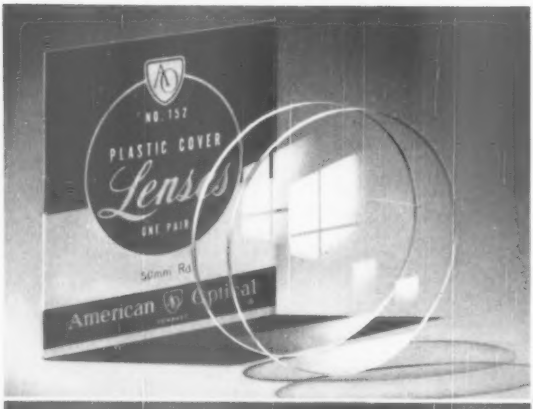
AO
Welders' Goggle
WITH
NEW PLASTIC
COVER LENSES

PROTECT

Valuable Filter Lenses from Pitting and Scratching

with NEW AO PLASTIC COVER LENSES



New AO Plastic Cover Lenses are inexpensive and highly practicable because they protect more costly filter lenses from pitting and scratching. They resist the fusion of hot metals and deflect weld spatter, sparks and flying particles. These thin wafers of clear plastic snap into place easily over the filter lenses of the new 329 and other AO Welders' Goggles—and outlast glass cover lenses 10 to 15 times.

New 329 Goggle — A comfortable well-ventilated "fortress over the eyes!" Snug-fitting, *non-reflecting* eyecups are individually molded of an extremely strong phenolic compound that's non-flammable, non-swelling, heat and moisture resistant. Side shields are designed to keep out rays, sparks and metal splashes—have indirect louver for ventilation to reduce fogging. Ball-chain bridge . . . wide angle vision . . . easily adjusted, one-piece headband . . . 50 mm Noviweld lenses in shades 3, 4, 5, 6 and 8—or Noviweld-Didymium lenses in shades 3, 4, 5 and 6

Order from your nearest AO Branch

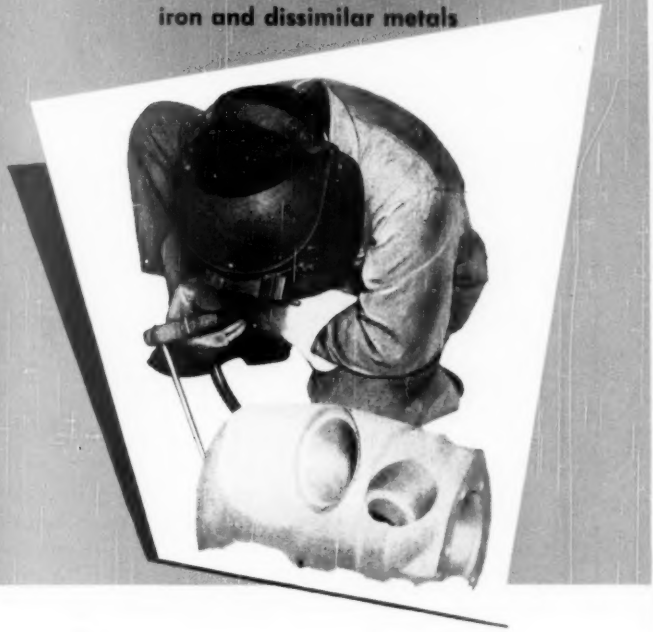
American Optical
COMPANY
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities

For Aluminum Bronze Weld Deposits of

high strength, high ductility and good corrosion resistance

on bronzes, cast and malleable iron and dissimilar metals



Specify AIRCO NO. 100 ELECTRODE

The Airco No. 100 is a shielded arc, general-purpose, aluminum bronze electrode for flat and horizontal welding with D-C, reversed polarity.

This popular electrode is used for producing sound, clean welds having high mechanical properties on bronzes, Muntz Metal and brass . . . and also on malleable iron, clean cast iron and steel.

For welding harder grades of aluminum bronze — in the flat position with D-C, reversed polarity — Airco Nos. 116, 120, 125 and 130 Electrodes are used for their properties as non-ferrous, hard, overlay deposits — which are corrosion and acid resistant.

For more information on Airco No. 100, as well as Nos. 116, 120, 125 and 130 Electrodes, write your name and address on the margin below and send it to your nearest Airco office or authorized dealer for a copy of Catalog No. ADC-650A.

★ ★ ★

Air Reduction supplies Oxygen, Acetylene and other industrial gases . . . Carbide . . . and a complete line of gas cutting machines, gas welding apparatus and supplies, plus arc welders, electrodes and accessories. Ask us about anything pertaining to gas welding and cutting, and arc welding . . . we'll be glad to help you.

More news about AIRCO products

STAINLESS STEEL ELECTRODES

Over 25 different types to fit most any problem involving the welding of stainless steels. For application with D-C, reversed polarity most electrodes are furnished with a heavy extruded lime type coating. For all position A-C or D-C application all but the straight chrome analysis are obtainable with an extruded titania type coating.

HORNET 36A D-C WELDER

A heavy-duty, high-speed, light-weight machine designed to furnish smooth, steady current for every D-C arc welding job — even under severe operating conditions. 200, 300 and 400 ampere sizes are available.

BUMBLEBEE A-C WELDER

This machine is known for its improved electrical efficiency at rated loads, wide current range, low open circuit voltage (75 volts), vastly improved power factor, quiet operation and minimum maintenance. There is a size available for every A-C welding purpose.

ELECTRODE HOLDERS

A complete line of Jackson tong type and Martin Wells screw type holders are available in various amperages and sizes.

AIRCO AIR REDUCTION

Offices in Principal Cities

Value Beyond The Purchase!

*Cross-section illustrating the exclusive Mallory Fluted water hole.**

Mallory Fluted Tips For Resistance Welding *Set New Records For Low Cost Per Weld!*

New reports are coming in daily . . . field experience proof that Mallory Fluted Tips are showing life increases ranging from 10% to 600%. As a result, more and more companies are standardizing on Mallory Fluted Tips.

There's no telling until you try them just what percentage increase these record-setting tips will show for you . . . but, *since they cost no more*, it's a sure bet that any increase in life means a cost reduction for you!

That's value beyond the purchase!

Why delay further? You'll start saving money the day you start using Mallory Fluted Tips. Prompt shipment can be made from stock . . . write now, advising your requirements!

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In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

REASONS WHY MALLORY FLUTED TIPS ARE SETTING WELDING RECORDS

- 70% increase in cooling area.
- Faster heat dissipation.
- Reduced mushrooming.
- Less frequent dressing.
- More rigidity.

Available in all types of tips with #1, #2, and #3 Morse tapers.

Resistance Welding Tips, Holders, Dies, Rod and Bars, Castings, Forgings

SERVING INDUSTRY WITH

Capacitors	Contacts
Controls	Resistors
Rectifiers	Vibrators
Special Switches	Power Supplies

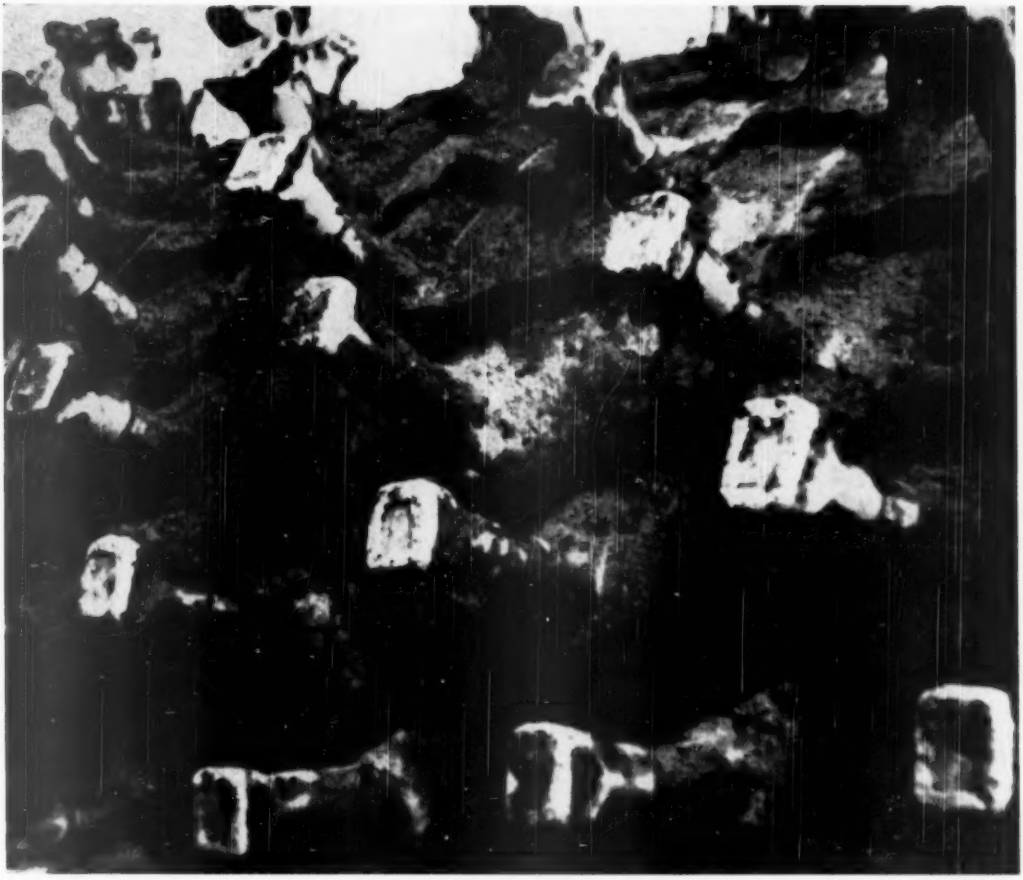
Resistance Welding Materials

*Patent Pending

P. R. MALLORY & CO., Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



No crippled feet here!

We've lifted their arches with Stoody Self-Hardening 21

REDUCED tamper foot area means *more passes* for the same result, *more time* expended, *more cost*. Yet, sheepsfoot tampers are among the simplest of all construction equipment to maintain and restore to better-than-new efficiency. A few beads of low cost Stoody Self-Hardening **21** around the outer edges of each foot give you two to four times more wear resistance where abrasion first attacks . . . feet stay flat, cover more area, insure a tight, even pack. Reapply Stoody Self-Hardening **21** as required. Each application adds extra life, makes cripples as good as new.

Complete information on maintaining all heavy equipment with Stoody Alloys is given in The Stoody Guidebook. Write for courtesy copy!

EFFECTIVE TAMPING AREA

Worn Foot *Rebuilt with Stoody Self-Hardening* **21**

STOODY Alloys

STOODY COMPANY
11941 East Slauson Avenue
Whittier, California

How the new Lincoln "Fleetwelder" cuts your costs seven ways

1. COVERS A WIDE VARIETY OF WORK.
Handles 5/64" to 1/4" electrodes.

2. HAS BROAD CURRENT RANGE.
N.E.M.A. rated 30 to 250 amps. with plenty of extra amps. in reserve.

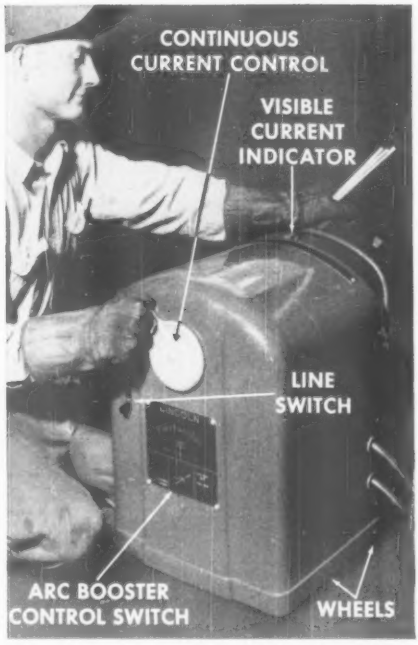
3. SIMPLIFIES AC WELDING.
The "Arc Booster" gives automatic arc striking.

4. MAKES STRONGER WELDS.
The "Arc Booster" gives full penetration instantly.

5. RUGGED IN DESIGN.
Built to withstand heavy overloads and physical abuse.

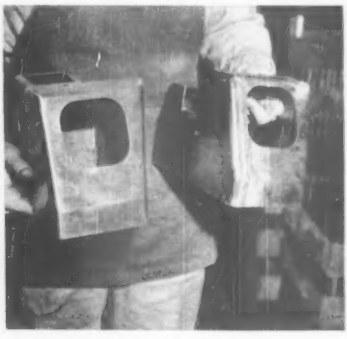
6. COMPACT AND PORTABLE.
Mounted on wheels . . . easy to move around.

7. SELLS FOR ONLY $180.00.
Today's best buy in Industrial AC Welders.



New Lincoln 200 amp. "Fleetwelder." Ideal for production, maintenance, sheet metal, garage repair, job welding.

Production Welding like fabricating these wheels is done faster, better and at less cost with the "Fleetwelder."



Light Work like these 16-gauge housings is now welded easier. "Fleetwelder's" "Arc Booster" permits lower welding currents without impairing easy arc striking.

Maintenance Welding such as replacing the keyway in this spur gear falls well within "Fleetwelder's" broad current range.

GET THE FACTS NOW

Send for free Bulletin 378 on "Fleetwelder" 200 AC.
THE LINCOLN ELECTRIC COMPANY
Dept. 71, Cleveland 1, Ohio

Sales Offices and Field Service Shops in All Principal Cities

LINCOLN

ESTABLISHED 1916 THE WELDING ENGINEER JANUARY, 1950

$1,400 a Second

CONGRESS COMES BACK to Washington this month for the second session of its 81st gathering. The President has told the members, in part at least, just what he expects them to do. His demands include a welfare state program and higher taxes. In a democracy such as we still purport to be, demands on Congress seem a bit out of order. The President, like the rest of us, does have the privilege of making his wishes known. That should be all. Yet everyone knows the Presidential wishes will carry a deal more weight with Congressmen than those of John Q. Public.

Even though the members of Congress are the "duly-elected representatives of the people," they are human and want to get back into office. Hence Representatives and Senators generally follow the path which they believe will lead them to another term. Consequently, they vote in accordance with elaborate political chicanery in which the interests of the majority are deliberately sacrificed to please minority pressure groups who can howl loud and long in concerted effort.

Excuse them, please, for they do know what they do. These elected officials realize that they don't represent a majority of the people, perhaps not more than a small minority. The last Presidential election demonstrated that 43% of our friends and neighbors didn't care enough about their precious heritage to amble down to the neighborhood polling place and cast a vote. In the face of such appalling public indifference, such glaring mass stupidity, is it any wonder that the Servant has become the Master?

John Q. Public has been notoriously inarticulate, but it is high time that he found a voice. We private citizens who are concerned with the perilous course on which our government is running should make our fears and wants known. If ever old John Q. does manage to speak out, I don't believe his directives on taxes will coincide with those of the President. I think that old John still has enough native common sense to recognize that the President is dead wrong in asking for taxes to be raised.

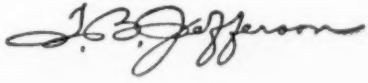
It's time that poor John had a break—or perhaps a brake would be the better spelling. Based on the fiscal year's report of expenditures, Congress and the Administration between them have figured out schemes for spending $45,000,000,000 of John's hard-earned coin. It's still John's coin, even though they have evolved a pretty slick scheme for sneaking it out of his pay envelope before he gets the chance to lay claim to any part of it. A $45 billion expenditure for one year means that Uncle Sam is spending John's dough at the rate of $1,400 a second. Pretty darn fast spending!

In the little over four years that our President has been in office, he has managed to get rid of something like $200 billion—more money than was spent by all his predecessors together unless you count the extraordinary expenses of World War II. It looks like we need a brake, all right, because we're running downhill at a rapidly accelerating rate. All the way down to the poorhouse!

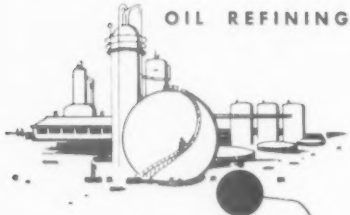
At the rate of $1,400 a second, how long will it take the Administration to spend an amount of money equivalent to your yearly income? Chances are all you can make in a good year will be spent in less time than it would take you to figure out how long it would take.

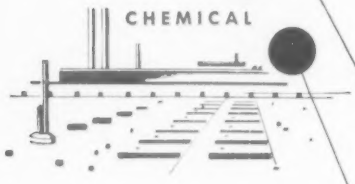
When taxes are eating up our sustenance faster than we can think about it, it's time to squawk. Let Congress know that what *you* want is economy in government so that more taxes won't be superimposed on the already big burden you are now carrying. Remind Congress that the Hoover Commission outlined a way to save $4 billion or more a year and that so far less than a fifth of its recommendations have been put into effect.

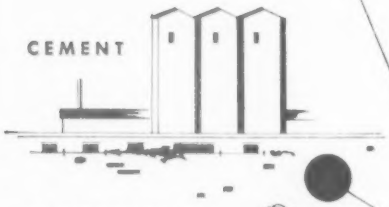
Instead of bigger and better taxes, we need a lower priced government, one that won't eat us out of house and home. We need a greater incentive to invest money in private industry. When a healthy return was a fair risk, private capital made the investments that built up practically every big industry we have today. Government has done little except squander the surplus earnings that make new investments possible. Let your Congressman know what *you* think about it.

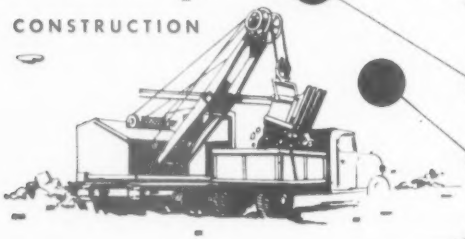


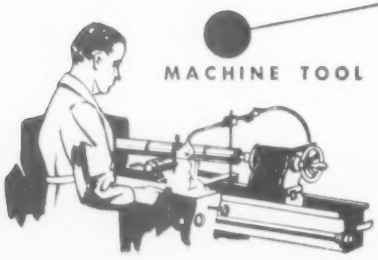
"Colmonoy"* SERVES ALL "Industry"











* ● Machinery is used in almost all phases of industry. This machinery is constantly subject to wear—wear is costly in time as well as money. Whether this deterioration is from friction, abrasion, corrosion, impact or excessive heat, COLMONOY HARD FACING ALLOYS will increase the life of these machines 3 to 28 times. Below are listed a few typical examples of actual case histories.

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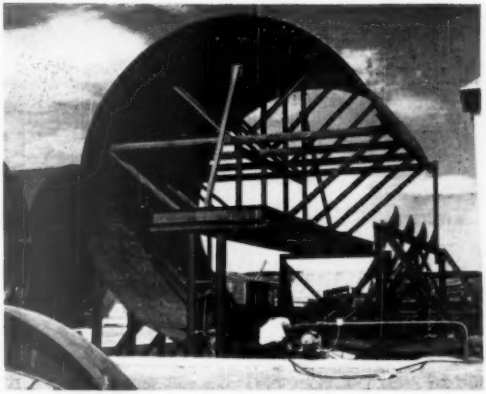
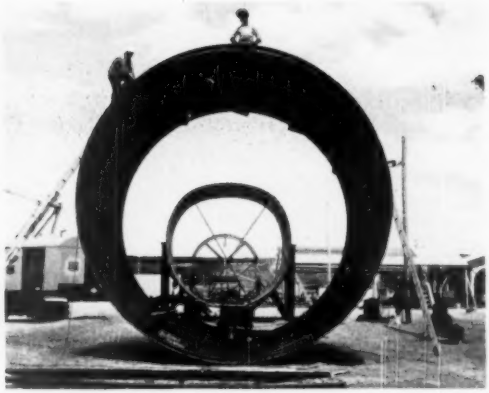
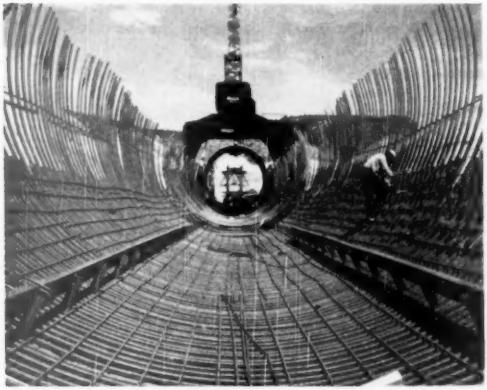


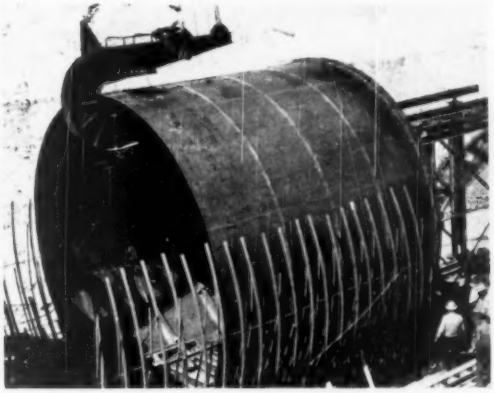
1—WELDED LINER plate is rolled into pipe section



2—CONTRACTION JOINT has "rolled angle" welded on



3—GANTRY CRANE straddles outer reinforcing rods



4—TO LOWER liner pipe in the building of a —

Siphon for Soap Lake

BUREAU OF Reclamation's Soap Lake siphon will have 4,500 ft of steel-lined concrete and 3,400 ft of reinforced concrete pipe without lining. Siphon, described as the largest in the world, is a part of the Columbia Basin project in eastern Washington.

To make the 22-ft-diameter liners, eight ¼-in. steel plates, each 8 ft 9¾ in. by 20 ft 2¼ in., are submerged-melt welded together into one giant plate measuring 20 ft 2¼ in. wide by 70 ft 2 in. long. These sheets are then rolled into a pipe section 22 ft 4 in. in diameter and 20 ft 2¼ in. long. Fig. 1 shows the big plate after it has completed about three-quarters of its journey towards becoming a cylindrical liner section. The section will be welded longitudinally after the ends have been brought together.

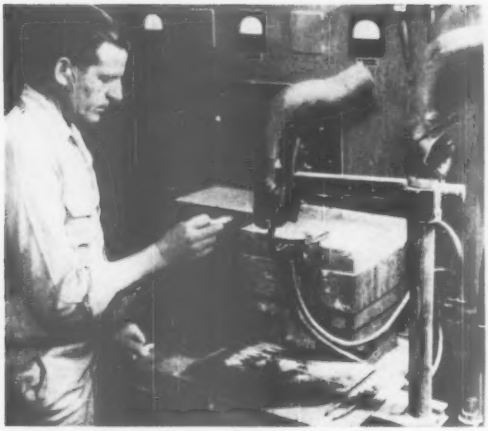
In Fig. 2, a contraction joint is having its "rolled angle" welded on. Section rests on two power-driven rolls for rotation during welding. In middle distance is pipe section in the "stiffener ring" jig, where the closing seam is welded and inverts and stiffener rings are installed. In the background is the "umbrella" which rounds the sheet steel into pipe sections.

Fig. 3, a longitudinal view of the siphon, shows the outer curtain of reinforcing steel for the lined portion of the barrel. Lined portion has an inside diameter of 22 ft 4 in., with 20¾-in. concrete shell. Unlined portion will have an inside diameter of 25 ft and a shell thickness of 2 ft.

Relation of the inner and outer reinforcing steel curtain for the siphon is shown in Fig. 4. The "hairpin" at top is locating the pipe section in the steel framework. The two jigs on the right are for the replacement of the light stiffener rings used in fabricating the pipe with the heavier stiffener rings that will be required when the concrete is being poured.

* * *

Prime contractors on the $7,614,000 contract are the Utah Construction Co. and Winston Brothers Co., Azusa, Calif. Subcontractor on the pipe-welding job is the American Pipe Co., Portland, Ore.



2—INDUCTION BRAZING of stainless-steel adapter to body portion of a "Wasp Major" intake manifold

3—INERT-GAS-SHIELDED-ARC machine welding of a jet-engine combustion chamber of 347 stainless steel

Welding Jet Aircraft

Precision welding of high-temperature aircraft components involves practically all processes, including induction brazing, inert-arc welding, submerged-arc welding and the resistance-welding processes

BY FRANK G. HARKINS
Welding Engineer, Solar Aircraft Co., San Diego, Calif.

UNTIL the advent of the jet engine, it was seldom possible to adapt automotive or electrical appliance manufacturing techniques to the production of precision aircraft parts. The reasons for this were many. Quantities were in terms of lots rather than in production runs. Shapes were extremely complicated, necessitating considerable hand work. General-purpose equipment had to be purchased because of the wide range of jobs to be covered.

Contrariwise, the manufacture of jet engines involves the fabrication of quantities of symmetrical precision parts. The aircraft fabricators have borrowed liberally of the procedures which were developed in the automotive industries. Flow lines have been established, and serious consideration is given to mechanical handling methods. Single-purpose welding machines are procured. Conveyor lines, both roller and overhead chain, are employed. All this is accomplished in the interest of producing better quality, low-cost parts.

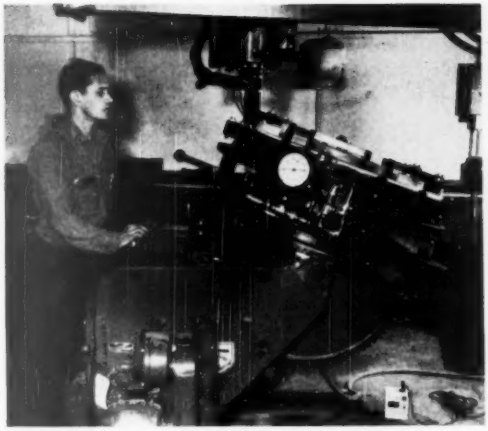
JOINING FOR HIGH TEMPERATURES

Metal-joining processes are a large portion of the activities of the jet aircraft fabricator. Mechanical joints such as those achieved by riveting, bolting, staking, etc., are not considered in this discussion. Soft solders have extremely limited applications for high-temperature service. Silver, bronze and copper brazing alloys are coming into more general usage in recent years because of the adaptability of the brazing processes to high production and the remarkably less distortion encountered at the medium-temperature range. However, welding is the most generally employed process for joining metals for high-temperature service. Welding also introduces the most difficulty in maintaining dimensions.

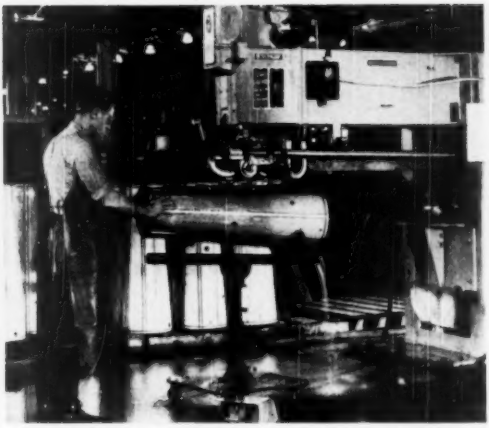
The problem is complicated by the fact that most of the common high-temperature materials have high rates of thermal expansion. For example, the coefficient of thermal expansion of stainless steel is approximately 50% greater than that of mild steel. Before getting into a discussion of welding methods and procedures, it might be advisable to review briefly the properties of the materials employed in building high-temperature aircraft parts. Such materials as stainless steels of the AISI 300 series and Inconel represent the largest tonnage of materials used. For special service, super alloys such as HS21 (Vitallium), N155, S816 are employed. The price range for these materials is from 60c per pound for the 18-8 steels to $8 per pound for the high-cobalt materials. Obviously, if a profit is to be made on a job, losses due to dimensional tolerances or poor welding practice must be minimized.

HOT-SHORT ALLOYS

Most of the high-nickel alloys have definite "hot-short" ranges, as is shown by Fig. 1. In welding terminology, the term "hot-short" or "red short" means merely that the material is brittle at some elevated temperature range. Study of Fig. 1 shows that at room temperature the elongation of the alloy is 49.5%. This elongation remains fairly constant to 800 F, after which it falls rapidly. At



4—SUBMERGED-ARC welding of stainless-steel ring on aft frame burner plate assembly of a J-47 engine



5—SEAM WELDING of J-47 aft frame cone is done on a d-c dry-disc rectifier welder of the triphase type

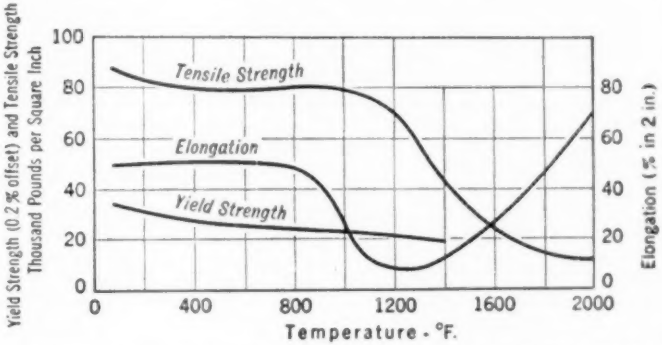
Engines

1,100 F it is 16.0%; at 1,200 F, 5.5%. However, recovery of ductility progresses from this point: at 1,400 F elongation has increased to 12%; at 1,600 to 32% and at 2,000 F, complete recovery has been achieved (66.5%).

Extreme caution must be exercised in passing through the critical ranges, either on the heating cycle or on the cooling cycle. This is the basic reason why high-nickel alloys may not be restrained during welding. In order to minimize restraint, it is always desirable to employ welding fixtures which provide a measure of upset force.

Induction Brazing

Now that we have touched upon some of the peculiar properties of some of the high-temperature materials, we will proceed with the discussion of the various processes which are used to join these fine materials. Brazing techniques employed in the production of precision parts include induction, furnace, dip and torch. Significant savings in labor cost may often be realized by induction brazing. Fig. 2 shows the induction brazing of a stainless steel adapter to the chrome-moly steel body of a Pratt & Whitney "Wasp Major" intake pipe. On this operation, heating time was reduced from 3½ minutes to 17 seconds. A single band of alloy is positioned, fluxed and placed on the brazing fixture. A further advantage, which is a direct result of the rapid heating time, is that heat distortion or misalignment of the part is nonexistent. When the adapter was torch brazed, it was necessary to jig align the part after brazing. Use of induction heating has made it possible to produce parts of better quality at less cost.



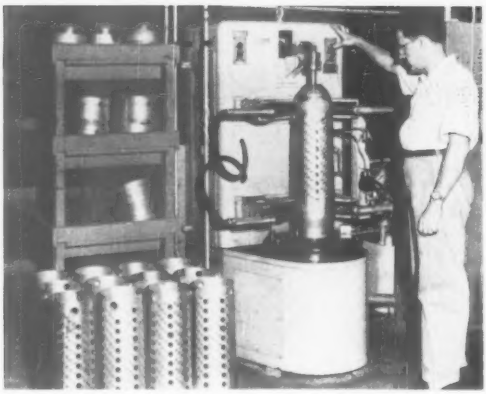
1—DIP IN elongation curve shows "hot-short" range of one alloy at 1,200 F

Welding processes employed in the fabrication of high-temperature aircraft parts include all of the commercially applied fusion and resistance techniques. Fusion-welding processes include oxyacetylene, metal-arc, atomic-hydrogen, inert-gas-shielded-arc and submerged-arc. Resistance-welding processes employed are spot, seam, projection and flash-butt welding. Recent trends have been toward an increased use of the resistance-welding processes, due primarily to the lack of distortion as a result of the localized heating. For the same reason, the machine fusion-welding processes offer distinct advantages over manual fusion welding.

Inert-Arc Process

Fig. 3 illustrates an inert-gas-shielded-arc butt weld of a J-47 jet engine part. The material is AISI 347 columbium-stabilized stainless steel, 0.050-in. thick. The welding speed is 40 ipm at 50 amp. The particular machine shown is a Solar development. It employs a copper back-up bar with a groove of approximately 0.187 in. by 0.015 in. No gas backing is employed since sufficient helium is forced through the unwelded seam to protect the underside from oxidation. No filler rod is used. It is of interest to note that the

6—ASSEMBLY-LINE production of outer combustion chamber requires a roller conveyor for the welders



7—MULTIPLE SPOT-WELDING GUNS assemble three component parts of the J-47 inner combustion chamber

joint thickness after welding is 0.0025 to 0.003 in. greater than the thickness of the parent material. The hold-down clamps, positioned extremely close to the weld seam, result in a narrow heat-affected zone and avoid excessive warpage.

The question of whether to use helium or argon shielding gas is of general importance. Much experimentation has indicated that for high-temperature materials in the gauges used for aircraft, helium may be employed to best advantage on machine welding applications while argon appears to be the better gas for manual applications. The basic reason for this is that the rate of heat transfer across the helium arc is so great that the operators have difficulty in controlling the weld puddle. On machine applications where the fit of the parts is ideal, the use of the helium shielding gas results in high-speed fabrications. The weld melt is very clean, with no oxide overlays. The lower rate of heat transfer with argon gas makes it desirable for manual applications. Arc length may be varied through a wide range without significant change in the rate of heat input. The use of argon gas enables novices to produce welds of high quality after only a short instruction period.

Submerged-Arc Welding

Fig. 4 is a picture of the submerged-arc welding of the aft frame burner plate assembly on the J-47 engine. The operation is the welding of a ring $\frac{3}{4}$ by $\frac{5}{8}$ in. and approximately 40 in. in diameter to the $\frac{3}{8}$-in. plate. The material is 347 stainless. Of particular interest in this fabrication is the fact that the filler wire is also type 347. The deposited weld metal meets all specifications for 347 material. Until the development of this technique at Solar, it was standard practice to weld type 347 material with the submerged-arc process by employing 29-9 wire. The reason for this practice was that 20 to 25% of the chromium was lost in passing across the arc, resulting in a weld deposit of 24% Cr—9% Ni, which can hardly be classified as type 347. You will note from the picture that the size and weight of the fixture in relation to the total weight of the part is somewhat disproportional. Herein lies a basic consideration in the production of precision parts. The parts are placed in the fixture, and the hydraulic pump is started; this expands an inner mandrel against the plate under hydraulic pressure of 600 psi. If the total force acting on the plate is calculated, the reason for the use of a 4,000-lb. fixture to weld a 50-lb. part becomes apparent.

Resistance-Welding Processes

A resistance seam-welding operation on the J-47 jet aft frame cone is shown in Fig. 5. As previously noted, the use of the resistance-welding processes results in less distortion of the parts. Weld shrinkage is so low that on most occasions it is unnecessary to allow extra material to compensate for the shrinkage. The welding machine illustrated is a special adaptation of the direct-current dry-disc rectifier type. One important feature of this equipment is its low-inertia welding head. The function of this head is to provide the fast follow-up pressure required by the high temperature alloys in order to minimize such welding defects as internal cracking, gas porosity, shrink voids, expulsion of metal, etc.

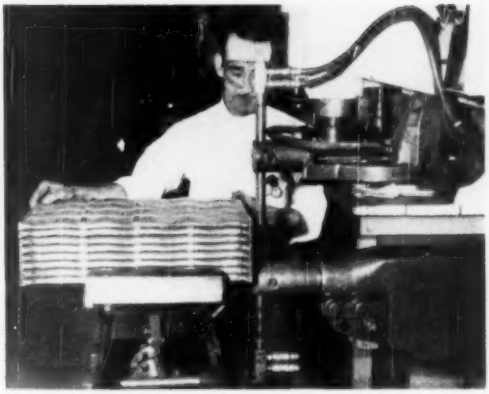
This advanced type of equipment is extremely helpful in maintaining welds of consistent aircraft quality. Materials and material combinations which were formerly considered not weldable may be readily processed. For example, Monel may be welded to mild steel on the triphase, low-inertia welder. When this combination of materials is welded with conventional a-c equipment, radial cracking results, so severe that leakage occurs directly through the weld from one outside surface to the other.

Because the welding is accomplished with steady direct current, the weld time may be significantly shorter. Direct current shortens the time required with 60-cycle alternating current, which must pass through the zero current point 120 times every second. Since the weld time is short, the heat loss by conduction is reduced, resulting in less heat dissipation into the work and consequently less distortion of the parts.

A typical roller conveyor system for use with resistance welders is illustrated by Fig. 6. This shows the various spot and seam welders employed on the jet-engine combustion chamber line.

Function of the special Solar-built multiple-gun spot-welding machine

8—GOOSENECK lower horn permits a part of complicated curvature to be welded over a full 180 degrees



9—OFFSET ELECTRODES combined with an indexing fixture solved a tough problem on a heat exchanger

shown in Fig. 7 is the assembly of the dome, body and skirt of the J-47 inner combustion chamber. Dogs and locator pins position the parts in relation to each other. After the machine is loaded, the start button is depressed. Four simultaneous welds per stroke are made. The part automatically indexes after each stroke of the guns until 24 welds have been made. The overall cycle time per part is 42 seconds.

An unusual application of roll welding (Fig. 8) resulted in the saving of some 80% of the labor time involved in the fabrication of a jet part by atomic-hydrogen welding. The latter process also resulted in a high rejection rate due to warpage. Rejections for warpage were completely eliminated after resistance welding was applied. Through the use of a gooseneck lower horn, it became possible to weld the seam in a single operation. Welding speed on this operation was 24 ipm. While the part is no longer in production, this picture is exhibited as an example of applied ingenuity in the fabrication of complicated shapes.

Another example of an ingenious fabrication is illustrated by Fig. 9. In the spot welding of a heat exchanger, the clearance for the electrodes is less than ½ in. The stand holding the part is an automatic indexing fixture, which is energized by the exhaust air from the welding machine. The operator merely depresses the firing switch and the machine spot welds at the rate of 12 spots per inch. A micro switch de-energizes the firing circuit at the end of the seam. The operator then raises the hydraulic jack, and the next row is welded.

Welding Fluxes

A discussion of this nature could not be complete without some reference to the welding flux. Welding fluxes are generally beneficial in aiding the weldor to achieve aircraft-quality welds. The function of a good flux is threefold:

(1) To protect the heated metal from oxidation by forming a protective blanket over the molten metal.

(2) To dissolve oxides present in the material.

(3) To reduce the surface tension of the melt so as to facilitate free flow of the weld metal.

To be effective, a flux should be liquid and active at a temperature of 800 F. Most high-alloy materials are scale-resistant up to this temperature. Since the high-temperature alloys bear little relationship to each other in physical properties or chemical analysis, it is obvious that no one welding flux will be best suited for all materials and processes. At least four are necessary.

One type of flux manufactured by Solar Aircraft is for the oxyacetylene welding of 18-8 materials. A second type, a higher melting flux, is used where dissimilar thicknesses of 18-8 are welded. It is also beneficial for back-up work on lap seams in metal-arc welding. A third type is used for inert-gas shielded arc welding of stainless steel and other iron-base materials. The fourth type is for Inconel and other high-nickel alloys, including "super" alloys. This is the most universal flux developed to date, and it is used in all welding processes.

Precision Welding Program

To summarize, it may be stated that the primary consideration in the fabrication of precision sheet-metal parts is adequate tooling. Some of the pictures have illustrated the extent of tooling required. For fusion welding, jigs and fixtures of large mass must be constructed if tight dimensional tolerances are to be met. Welding should be accomplished as quickly as possible so as to avoid long exposure of the metal to welding temperatures. Chill bars must be provided to minimize heat dissipation into the sheet metal.

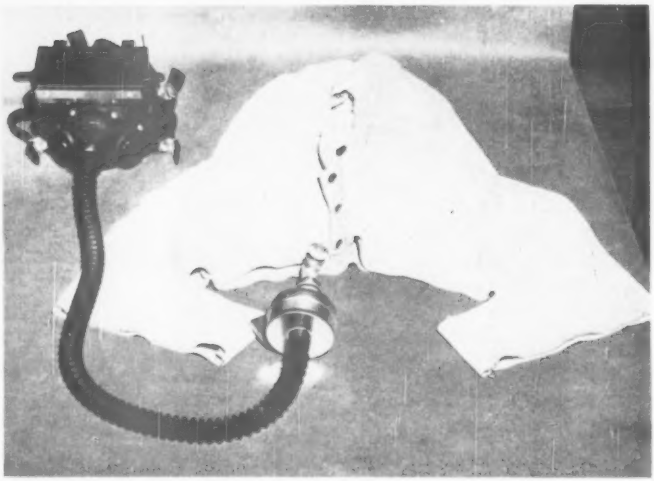
Resistance welding may be employed to excellent advantage to do precision welding of sheet metals. Cost reduction is sometimes phenomenal, although this is often secondary to the production of satisfactory light parts. Positioning fixtures for resistance welders may be considerably lighter than fusion-welding fixtures since heat distortion is not a serious problem.

Possibly the most important qualification in any precision manufacturing program is to employ as many machine feeding and indexing fixtures as possible. This type of automatic action results in consistently high-quality welds because it minimizes the human element and its accompanying possibilities for error.

A "New Look"

1—STANDARD TYPE of welding helmet consists of a covered top, curved bottom and holder for lens

BY W. L. BELL
Industrial Department, Mine Safety Appliances Co.



3—COMPRESSED AIR is fed through a hose to the wearer of above mask

The arc weldor is a conservative in dress, having worn the same welding helmet for around a half century. Nevertheless, some new special types have been designed and other changes are in prospect

FOR THE PAST half century a large black mask enveloping the face and head has been more or less the identifying trademark of a weldor. The reason little change has been noticed in the appearance of this costume is that the first design was well engineered. In fact, the first patented standard-design welding helmet to be placed on the market is still being manufactured.

The above paragraph does not mean that there have been no changes. Over the years a number of design modifications have been made to incorporate better materials into protective masks for weldors and to meet changing conditions in the industry. Today, research in this field is concentrated chiefly on the development of special lenses to help weldors perform their duties more efficiently and faster.

To Reduce Glare

In any welding operation, the most glaring visible radiation usually appears as a relatively narrow range of wave lengths identified by the color of light produced. Lenses under development are intended to reduce the light transmission in these narrow color bands and to permit additional transmission in other parts of the visible spectrum. This will reduce glare without excessively limiting vision.

One result of the development work is a lens for the high-temperature welding of aluminum. This combines the properties of regular filter lenses with the additional advantage of screening sodium flare, allowing the operator to see the weld more clearly. Orange and red color values are preserved, making the bead and molten metal brilliantly visible. Hence the weldor can control formation of the bead more carefully.

As soon as gas and arc welding had been introduced in this country, the requirements for protection of operators were immediately apparent from the hazards involved: intense heat, brilliant light, showers of tiny molten metal particles and invisible radiation. Even before safety measures were given much attention as such, the fact that the blinding arc interfered with efficient workmanship had made it necessary to use a darkened lens.

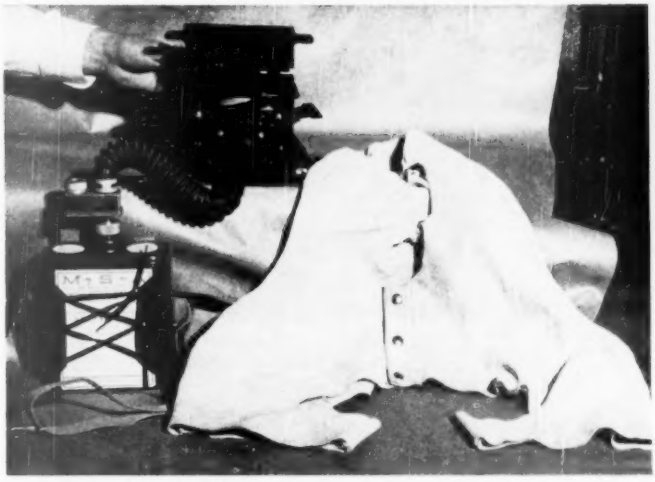
Why Vulcanized Fiber

The search then began for proper materials to use in the manufacture of welding masks. Leather and vulcanized fiber were both used for early commercial models, but the latter is lighter in weight and is today by far the most popular. It is made by gelatinizing paper, which is then pressed together several layers thick. Vulcanized fiber usually is prepared from cotton rags, but substitute materials have been used successfully.

Two processes are employed in manufacturing vulcanized fiber. One involves gelatinization of cellulose in a zinc-chloride solution and the other gelatinization in sulphuric acid. The latter is used for thin stock. In both processes, the paper is subjected to heat and pressure.

This material can be readily punched, drawn and formed. It offers insulation against electricity, heat and noise, has a comparatively high tensile strength and is insoluble in

for Arc Weldors?



4—CHEMICAL CANISTER purifies the air in another new type of mask

2—"HARD HAT" combined with welding helmet gives head protection on jobs where it may be needed

ordinary solvents such as alcohol and naphtha. The material is usually dyed black since the increased heat-absorbing qualities of black are not as injurious to the wearer as reflected rays would be to bystanders if lighter colors were used. In certain cases, aluminum-colored masks are used to deflect intense heat. When such masks are used, the welding is done in a closed booth to prevent the reflected rays from reaching other personnel.

Eye Protection

In the early days it was customary to assume that if the visible rays were reduced to a comfortable intensity, the ultra-violet and infra-red rays would also be reduced proportionately. Common practice was to use alternate layers of red and blue glass to reduce intensity. Whether these afforded complete protection is a debatable point because some glass absorbs visible rays while freely transmitting ultra-violet and infra-red rays. Soon the harmful effects of invisible radiation became apparent, and a new type of filter glass was developed.

Thin coatings of gold, silver and other bright metals on the glass permitted passage of enough visible light to see by while reflecting much of the invisible radiation. Though these harmful rays were prevented from reaching the weldor's eyes, in some instances they were reflected into the working area.

The next step was to add small particles of metal to glass in the molten state. More recently, it was learned that iron oxide, a contaminant which gives clear glass a greenish cast, is one of the best absorbents of infra-red rays. This and other pigments such as vanadium oxide now are used in lenses.

Research by the optical and glass industries, the National Bureau of Standards, the American Standards Association and other organizations has resulted in well established lens specifications for all types of welding. Table I, which shows the shade of welding lens necessary for various electrode sizes, has been complied from a number of authoritative publications.

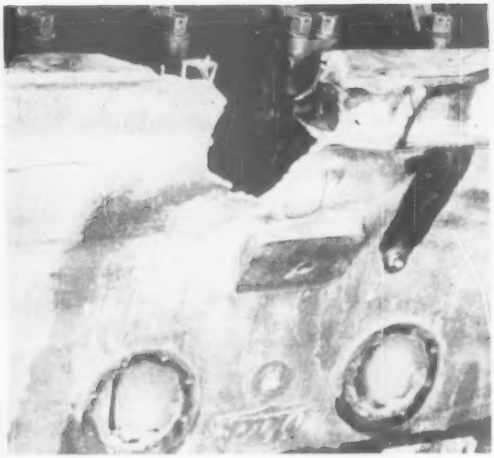
Although the basic appearance of the standard welding helmet (Fig. 1) has not changed materially, some special types are designed to meet various operating conditions. To the standard helmet, consisting of a covered top to protect the frontal portion of the head and a curved bottom to shield the under part of the chin, have been added snoods of chrome leather or fireproof duck and bibs of the same material for more complete protection from sparks and splashes.

Helmets are mounted on headgears adjustable to all head sizes. These are also of vulcanized fiber and are made so that the face shield can be pivoted upwards to allow intermittent inspection of the weld. The lens holder may be either of metal or

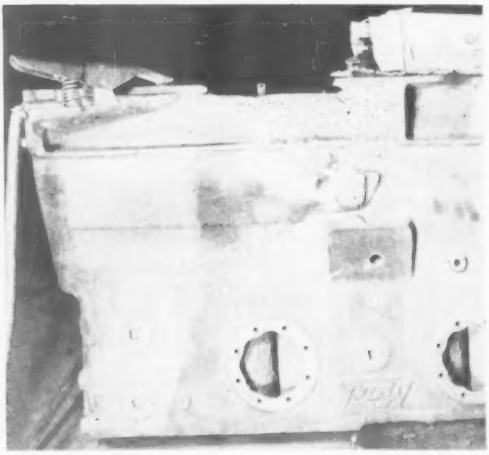
(Continued on page 25)

Table I. Shade of Welding Lens Needed with Various Sizes of Electrodes

Type of Welding	Electrode Diameter, In.	Current Setting, Amperes	Shade No.	Percentage of Transmission			
				Visible Light	Infra-red	Ultra-violet 313-365 Milli-microns	Ultra-violet 405 Milli-microns
Metal-Arc	1/16-3/32			.037	.8	.1	.5
	3/32-1/8	75 to 200	10	.0139	.6	.1	.5
	1/8 -5/32		11	.0052	.5	.05	.1
	3/16-7/32	200 to 400	12	.0019	.5	.05	.1
	1/4		13	.00072	.4	.05	.1
	5/16-3/8	400 and up	14	.00027	.3	.05	.1
Carbon-Arc			14				
Atomic-Hydrogen			14				



1—BEFORE WELDING: Hole torn by the broken connecting rod at oil-pan flange measures 11 in. across



2—STEEL PATCH has been welded into side and new section of reinforcing rib carefully tacked in place

Bus Cylinder Block

Students at the Arizona State College Vocational School were given a beautiful home-grown exercise when a broken connecting rod on a school bus poked an 11-in. hole through the cylinder block casting

BY FRANK GIANELLI

Arizona State College Vocational School, located at Thunderbird Field II near Phoenix, practices what it preaches about welding.

Recently, one of the school's 52-passenger Diesel-electric buses broke a crankshaft and the connecting rod tore loose. It poked an 11-in. hole through the cylinder block at the oil-pan flange (Fig. 1), a hole big enough to allow the piston to be removed through it.

The school had an excellent home-grown application of how to lay out and complete a big job of repair.

Patched with Steel

Under the supervision of Welding Instructor George Hunt, the pupils carefully studied preparation and control of expansion and contraction before they tackled the actual job. The original cast iron pieces punched from the block were unavailable for repair purposes since they had been scattered over about five miles of highway at the time of the accident. Hence mild-steel patches were cut for the repair and applied by means of a 200-amp d-c arc welder and a $\frac{1}{8}$-in. electrode developed for welding cast iron.

The side patch, a 3/16-in. mild-steel plate, was bellied out slightly before welding to fit the contour of the casting. Anchor pegs were drilled into the block to hold it in place. Welding was done with the block cold, and it is interesting to note that there was little chill cracking. Single passes were used wherever possible, multiple stringer beads only where necessary. A stepback technique was employed, welding about an inch at a time and keeping the weld area cool enough to touch with the bare hand most of the time. Peening was restricted to a minimum; Hunt says that he isn't much of a hand for hammering a weld job together in cast iron.

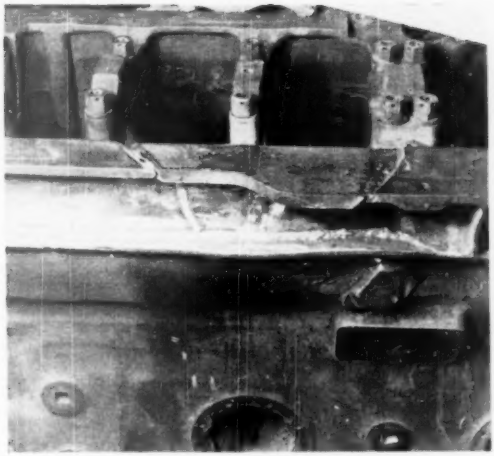
Fig. 2 is a view of the block after the mild-steel patch had been welded into the side, and a new section of the reinforcing rib tacked into place. The most trouble encountered on the job was with the reinforcing rib because of the tendency of the mild-steel bar to overheat.

At the top of the block, the oil-pan attaching flange was repaired by welding in a flame-cut section of $\frac{1}{2}$-in. mild-steel plate. Fig. 3 shows how the edges were beveled in preparation for butt welding.

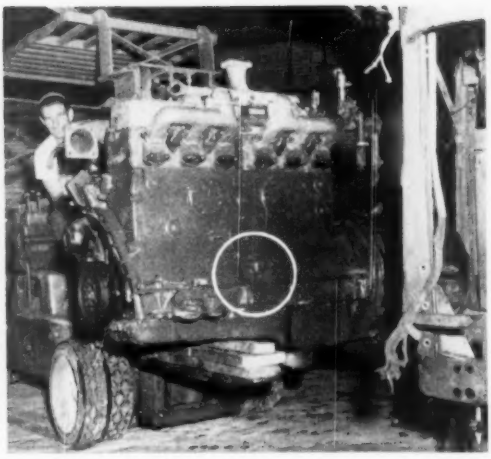
$400 Saving

With ten hours' labor and four pounds of electrodes, the job was completed at a saving of more than $400 below the cost of a new block. And the bus was restored to service far sooner than if a new block had been ordered and substituted. Since the repair, the engine has been run for several hundred hours without signs of trouble.

The ten hours' labor required included cutting of the patches, welding and also the repair of an internal oil line ruptured by the break (Fig. 5). The latter was drilled clean. No mandrel was available for holding the block's main journals in line, and it was thought that these would have to be line bored when the job was completed. After the welded block

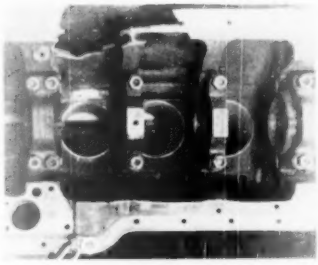


3—NEXT STEP was to tack and weld the oil-pan attaching flange. Note how the plate edges were beveled



4—AFTER REPAIR, cylinder block is replaced in the bus. White circle shows location of welded area

Repaired by Welding



5—INSIDE VIEW of block shows break in oil line at No. 3 cylinder

had cooled, however, careful checking showed such slight warpage that line boring was unnecessary.

The Arizona state vocational school has more than 250 students enrolled, most of whom are former service men training under the G. I. bill. A variety of courses are given in welding, auto mechanics, refrigeration and equipment maintenance. Actual repair and maintenance jobs are used for instruction purposes. As there is no heavy industry around Phoenix, the welding training emphasizes layout, cutting and general shop practices.

"Take your own medicine" is a very good slogan for a vocational school to follow.

"NEW LOOK" FOR WELDORS

(Continued from page 23)

plastic. It contains a filter lens and a clear cover glass, purpose of which is to protect the more expensive filter lens from weld spatter. Now available are coated or plastic cover lenses that are better resistant to pitting than glass.

Some lens holders have an extra hinged window to hold the filter and cover lens. Such a window permits the dark lens to be lifted from the path of vision while the clear lens remains in position to shield the eyes from flying particles, dust and similar hazards.

Some Special Types

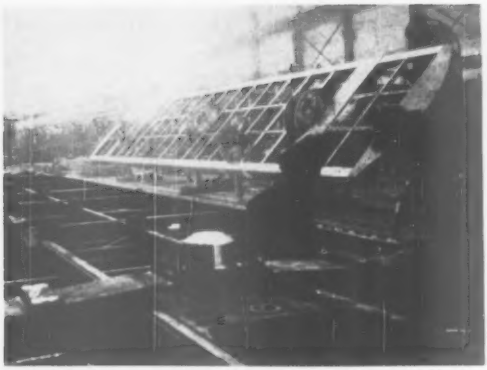
Combination welding helmets and protective hats (Fig. 2) are available for weldors working in shipyards, refineries, steel mills and on construction jobs where head protection is required. These are designed so the mask can be lifted without removing the protective hat. A recent improvement enables the mask to be taken off entirely without doffing the hat.

Other new refinements in protective equipment for weldors include several new types of masks for working in atmospheres harmful to the respiratory tract. One type (Fig. 3) consists of an all-rubber gas-mask-type of facepiece to which filtered air is fed from the plant's compressed-air system. It is designed to be worn in atmospheres not immediately dangerous to life or from which the wearer can escape without a gas mask. A rectangular lens holder similar to the hinged-window type is fitted with a filter and a cover lens.

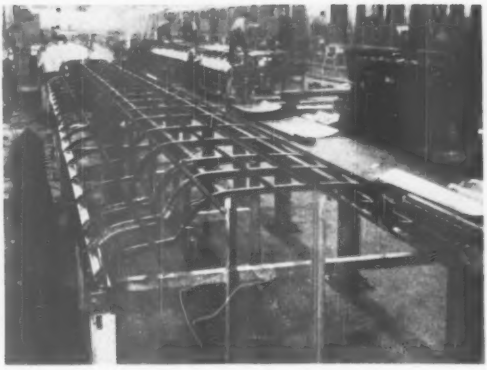
Another type with the same facepiece utilizes a chemical canister to purify the air (Fig. 4). This combination is specified for atmospheres in which gaseous concentrations do not exceed 2% by volume.

When oxygen is deficient or the atmosphere is highly gaseous, the welding mask used is equipped with a facepiece to which is attached a double corrugated rubber tube leading over the weldor's shoulders to an oilproof hose supplying fresh air from an outside source.

In the research laboratories of welding equipment manufacturers, scientists are continuously searching for new and better materials and methods to protect weldors and make their safety costumes more comfortable. There is no doubt that the future may have a "new look" in store for weldors.



UNDERFRAME being set up for welding (foreground): Underframe in the positioner (right) is being welded

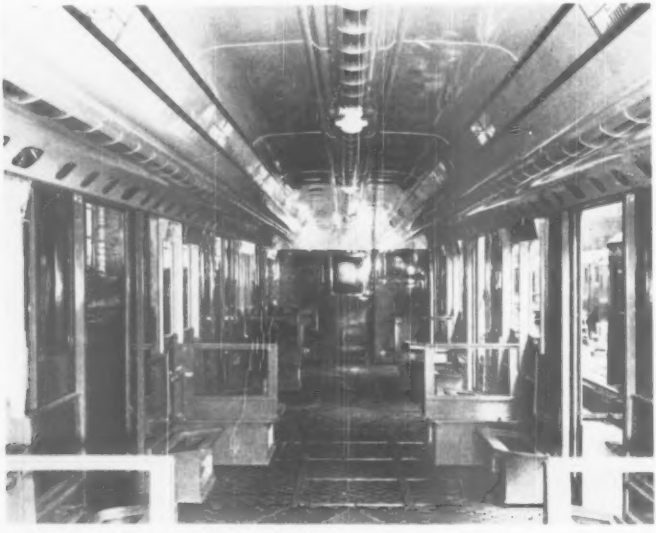


ROOF ASSEMBLY jig with structural members ready for welding. In background, roof sheets are applied

New Subway Cars

Subway riders are getting a real break in the 750 cars being built for the New York City Board of Transportation. These cars are of high-strength alloy steel and are spot welded a whole side at once

TWENTY-ONE outstanding improvements feature the 750 welded subway cars being built for the City of New York by the American Car and Foundry Co. at Berwick, Pa. About 550 cars have been completed. They represent the first the subway has put into service since before World War II and mark the beginning of the long-anticipated postwar improvement program planned by the Board of Transportation.



INTERIOR ROUGH trim and subfloor have been added in the finishing department. From finishing, the car goes to the paint and trim department

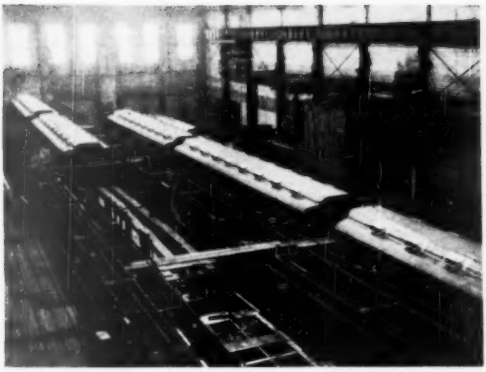
From the standpoint of the passenger, many of the improvements will mean less eye strain. The two-tone exteriors are dark gray below the windows and light gray above, with two-inch orange stripes above and below the windows. Flooring is blue gray with a yellow safety strip of flooring at each door. The plastic upholstery is a rattan chain design of green and yellow. Fluorescent-lighted route and destination signs replace the present plate type.

Better riding cars have been insured by improved type of traction motor control and braking equipment and by the use of roller bearings and vertical and lateral shock absorbers on the trucks. Roller bearings mean a much easier train start.

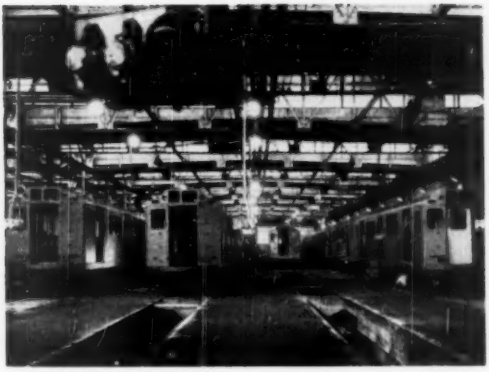
Welded Car Bodies

The use of low-alloy, high-tensile steels in construction has permitted the car weight to be reduced to 36 tons. The welded body construction has resulted in a sturdier car, even though lighter.

Every safety device for the protection of passengers has been included in the design of these cars. Doors are interlocked with the motor control equipment, making it impossible for the motorman to start the

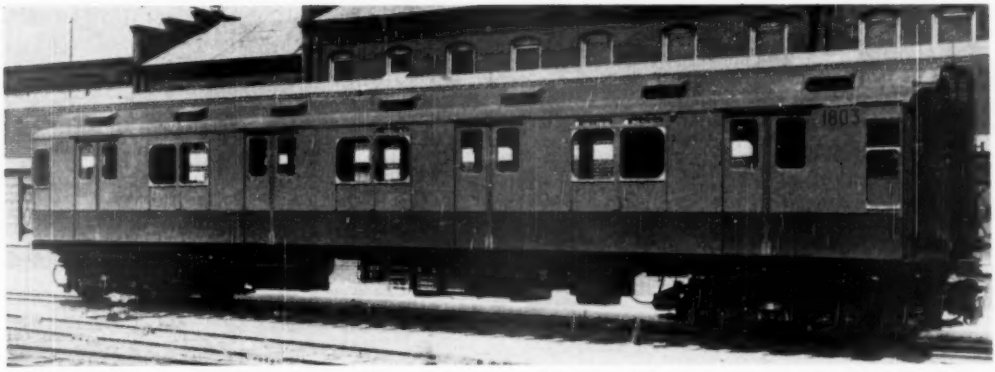


CAR SIDES are set up in the left foreground while roof subassemblies (right) are added to the structure



IN FINISHING shop, the cars receive floors, air brakes, electric wiring, doors, seat supports, etc.

for New York City



TWO-TONE PAINT JOB helps complete the improved-type car. Exterior is dark gray below windows and light gray above

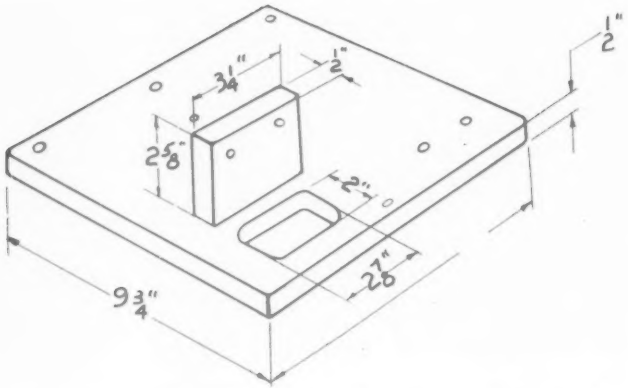
train until all doors are safely closed. Conversely, they cannot be opened again until the train comes practically to a standstill. Electric tail lights are automatically controlled.

The construction of the cars consumes an almost unbelievable amount of material. In each car there are over 7,893 ft of wire, 2,039 ft of aluminum conduit and 180 conduit fittings. There are 6,000 pressings, structural shapes, plates and forgings made to complete just one car. And even though welding is used to a large extent, 9,570 rivets of all kinds go into each car along with 8,068 machine screws and 1,113 bolts of various descriptions.

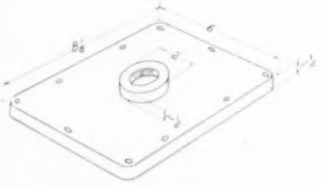
Construction of subway cars of an entirely new postwar design at the rate of two cars per day is an undertaking requiring the skill and experience of all members of American Car and Foundry. It is interesting to note that work of some kind for the subway cars has been or is being carried out in 135 of the 350 structures which comprise ACF Berwick. Approximately 20 months of engineering were required for the design of tools, fixtures and jigs alone. Many thousands of working hours were required for the fabrication of these tools, fixtures and jigs before any single finished item was made. Nearly 500 tools were designed and/or built at Berwick.

One of these tools is a large multiple spot welder used in the manufacture of subway car sides. Especially built for ACF, this machine is the only one of its kind. Each side is welded at 1,728 places against an 18-ton copper plate 170 ft long, 8 ft 6 in. high and ½ in. thick. This large plate is backed up by reinforcing copper castings weighing 95 tons. The machine is designed to weld the sides for two subway cars in an 8-hour shift. The traveling car welder makes two series of spot welds at the same time and can be indexed from ¼ to 18-in. spacing. While the weld is being made, it is sprayed with water to assure proper cooling of the metal during the operation. The

(Continued on page 31)



1—PUMP MOUNT PLATE above requires only two pieces to be welded and is equally simple to produce in cast iron



5—TWO-PART COVER can be made cheaper up to ten by welding

Weldments vs.

Cost comparisons for several parts produced as a weldment and as a cast-iron structure, in lots of 1, 10 and 50, are offered here by a leading builder of machine tools. Welding need not be ashamed

SOME of us can remember about 25 years ago when the machinery industry designed practically all major and semimajor parts for static sand casting in cast iron, steel, malleable, bronze, etc. Since that time, new products and intensive study have proved that other materials and methods can be economically successful in competing with these static sand castings—weldments, centrifugal castings, plastics, permanent mold castings in cast iron and aluminum, powdered metal castings and the like. These new and improved products have made the economic problem of determining when and what material or form of material to select for a design much more complex. However, it is the object of this article to compare only weldments and cast-iron structures.

It should be understood that all of the data cited apply to a specific plant engaged in the manufacture of machine tools and may not be applicable to other plants or products.

Foundry and Weldery

Our company houses the foundry (including the pattern shop) and the weld and sheet-metal shop under the same roof. The foundry pours Meehanite iron and produces castings in sizes ranging from ½ to 36,000 lb, which means a range in molding machine equipment from small squeezer molding machines through the largest rollover jolt equipment and into the larger pit work.

The weldery and sheet-metal shops are equipped with ample facilities for welding, flame-cutting, bending, forming, grinding, rough machining, shot blasting, stress relieving, grinding and painting. Welded parts constructed range in weight from 1 to 36,000 lb.

Our work is of a job-shop nature, many parts being for specially designed equipment having a production quantity from 1 to 10 pieces per lot. Our standard equipment calls for production lots of from 20 to 150 pieces, repeated several times yearly.

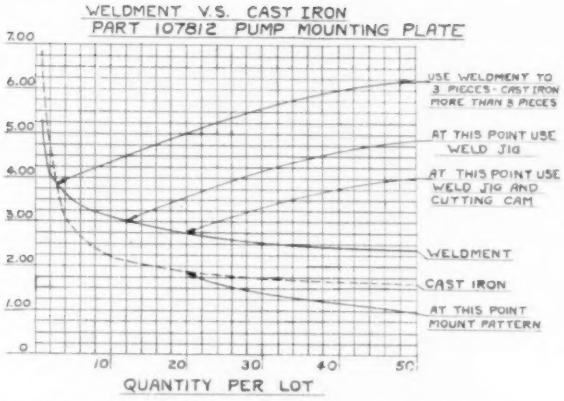
Having a pretty fair idea of our production quantities and our facilities, the next thing is to establish a common basis for determining the cost of the product. In the costing system used in this comparison, the measured productive unit is the common factor for all items of cost control excepting metal and stress-relieving costs, which are based on net pounds of material. For the sake of simplicity, we shall compare only the productive units per piece for steel (welded fabrication) and cast iron (foundry production).

Because of the range in size and type of work, there will be several costs per productive unit, depending on which manufacturing center or centers are involved in the operations. In the weldery, there are five cost centers: cutting materials, forming, assembly and welding, finishing, machining. In addition, the pound cost for metal and stress relieving must be considered.

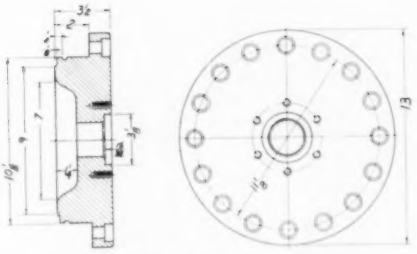
In the foundry, there are four cost centers, one for each department; namely, core-making, molding, mold assembly, finishing. In addition, there is also the pound cost for metal and stress relieving. The pattern equipment or tooling costs involved will be brought into the picture later as the examples are given.

With this cost data on hand, we can determine when a job should be made as a weldment or when it should be made in cast iron.

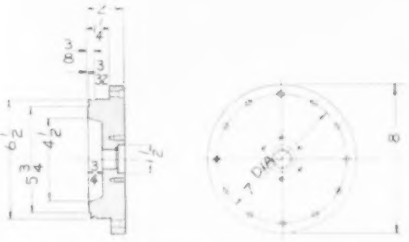
All of our examples will involve structures of metal section ¼ in. or more and the machining costs



2—CURVES of minimum manufacturing cost for the pump mount in quantities from 1 to 50. Weldment is the solid line, cast iron the dotted line. Note crossover point at three pieces

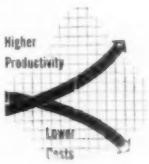


3—CYLINDER HEAD, a 13-inch disc, was flame-cut from 3½-in. steel and also cast. Steel took more material, and extra machining



4—SMALLER HEAD, 8 in. in diameter, was flame-cut from 2-in. steel and made in the foundry. Cast iron had the weight advantage

Castings



BY LAWRENCE NABERHAUS
Industrial Engineer,
The Cincinnati Milling Machine Co.

will not be brought into the picture. If either a weldment or casting should have the advantage of eliminating a machining operation, however, this will be reported. Usually, for the same operations, a lower cost prevails on the machining of cast iron.

Usually, a lower cost on designing prevails on cast parts than on weldments. This is partly because of our engineers' greater familiarity with cast designs and partly because of the less complex data. Under such data are included the bill of material, numbering of component parts, number of separate drawings required to fabricate component parts, etc.

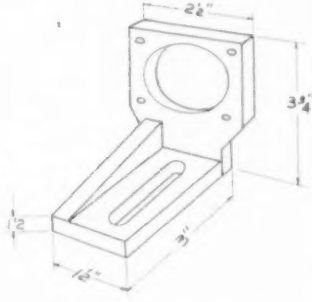
In all of our examples, the weldment design is compared with cast iron, assuming, of course, that the substitution can be made. In general, the welded production in steel costs less for one piece, but in lots of 10 or more cast iron is more economical.

Simple Plates

Our first example is a cost comparison on a basic part which requires the least operations to manufacture, both in the weldery and the foundry. This part is a flat plate 9 by 8 by 1½ in. having four corners rounded with 1½-in. radii. With steel, two operations are performed: shape-cutting of the steel plate and finish grinding of the cut perimeter. The productive units required per piece are 31.0, 13.4 and 6.7 for lot quantities of 1, 10 and 50. Under lots of 50, multiple-torch cutting was done with a magnetic template-follower. With cast iron, the productive units required per piece for the same 1-10-50 lot quantities are 75.9, 20.1 and 12.0.

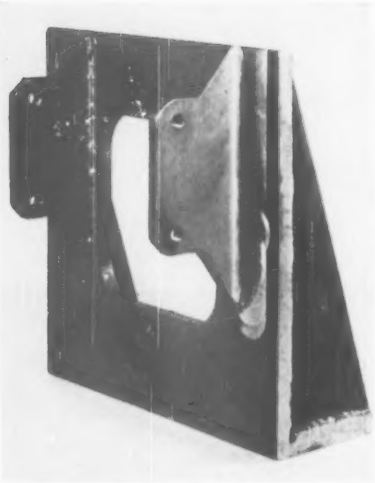
Our second example is a cost comparison on a large piece of the same type, an 18 by 12 in. block 2 in. thick. In this case, the size of casting made it necessary to change molding departments in the foundry, in which department hand-operated overhead cranes, solid flasks, mold drying equipment and bench clipping were necessary to produce this casting. The comparison gives the advantage to steel for all quantities. For steel, productive units per piece were 39.3, 18.0 and 9.0 for quantities of 1, 10 and 50. For cast iron, same quantities, the units per piece were 121.4, 56.3 and 38.4.

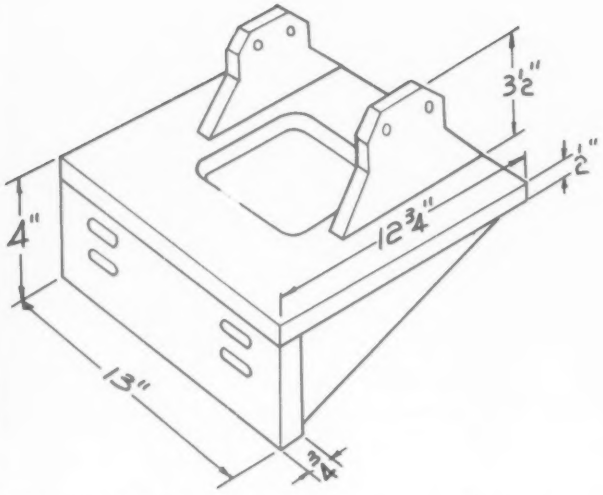
Fig. 1 shows a pump mount plate



6—THREE-PART support. Weldment is cheaper in single quantities

7—MOTOR BRACKET of four component parts. Pattern costs alone are nearly three times the cost of the first weldment—420.0 as against 144.6 productive units





8—BRACKET OF SIX component parts. Welding loses initial cost advantage before the tenth piece has been made

For one piece, steel required 199.5 productive units; cast iron, 339.9

in which two pieces are required to make the weldment. For steel, 1-10-50 lots, units per piece were 52.3, 26.5 and 17.8. For cast iron, same lots, units per piece were 114.9, 24.9 and 14.3. Fig. 2 shows curves of minimum manufacturing cost for any quantity, 1 to 50, for the pump mount. The solid curve is that of the weldment, the dotted curve that of cast iron. The crossover point is found at three pieces, where cast iron becomes more economical to use. The chart also shows that the pattern should be mounted at 20 pieces, that a simple locating weld jig should be used at 12 pieces, and that both weld jig and cutting cam should be used at 20 pieces.

Cylinder Head

Fig. 3 is a drawing of a 13-in. cylinder head. In steel, the requirements are a 13½-in. diameter disc, 3½ in. thick. In cast iron, the casting would take in the complete contour as shown on the cross-section. The cost comparison of this cylinder head reveals a weight differential between steel and cast iron—135 lb for steel, 78 lb for cast iron—and that extra machining was required to remove the surplus metal in the case of steel. Nevertheless, the overall cost comparison for one piece gives the advantage to steel; 104.2 total productive units as against 190 units for cast iron.

Fig. 4 shows an 8-in. diameter cylinder head. In steel, the requirements are an 8½-in. disc, 2-in. thick, and in a casting the complete contour could be made. Again, there is a weight differential in favor of cast iron and extra machining required for steel. Total units for the first piece, however, are 58.8 for steel as against 113.0 for cast iron. In lots of 10, units per piece are 47.5 for steel and 23.0 for cast iron; in lots of 50, 42.8 for steel and 11.3 for cast iron.

Two-Part Cover

Fig. 5 is a cover of two parts; a plate 8⅛ by 6 by ½ in., saw cut from stock, and a 2-in. boss, also saw cut. The bottom of the plate must be disc ground; therefore, extra finish must be allowed on the casting. A small positioning jig was used for the welded production in lots of 50. For steel, productive units per piece in lots of 1-10-50 are 23.2, 13.6, 12.1. For cast iron, comparable units per piece are 87.8, 20.3 and 11.2.

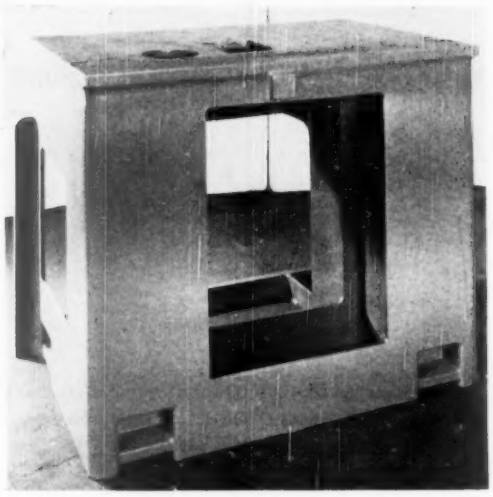
Fig. 6 shows a support of three component parts, two of which are saw cut and one flame-cut. For lot quantities somewhere between 10 and 50, two patterns would be used in the same mold. Units per piece for steel are 103.5, 61.2 and 39.6; for cast iron, 134.6, 26.6 and 13.7 in lots of 1, 10 and 50 respectively.

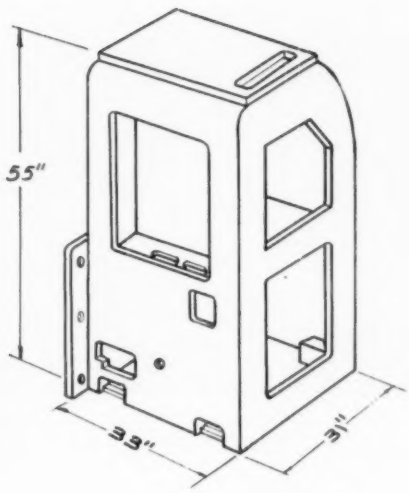
Fig. 7 is a motor bracket of four component parts. In this case, pattern and rigging alone are almost three times the cost of the first weldment—420.0 units as against 144.6 units. For quantities of ten or over, however, the casting is more economical.

Fig. 8 shows a bracket of six component parts. Two of the side struts are sheared from ¼-in. material; the other parts are either shape-cut or cut from bar stock. For one piece, steel required 199.5 productive units; cast iron, 339.9. For 10 pieces, steel required 117.5 units per piece; cast iron, 51.9.

Headstock for Milling Machine

Fig. 9 is a drawing of a headstock for a special milling machine. Up to this time, we have taken only elementary and simple parts. This part, however, is of box-type construction with internal ribbing, necessitating the use of cores in foundry practice and requiring bending and shaping in case of the weldment. The material generally is of ½ in. to ⅝ in. sections, excepting the flanges and top plate, which are 1¼ in. Overall dimensions are 55 by 33 by 31 in. The weight of the weld-





9—HEADSTOCK for milling machine is more complicated by either process. Welding has cost advantage up to ten

ment is 1,760 lb while that of the casting is 1,900 lb.

The one-piece cost ratio of 0.54 indicates approximately a 2 to 1 advantage for the weldment. For a lot of 10, the cost ratio of the weldment to the casting is 1.0, signifying like cost. For a lot of 50, the ratio is 1.1, a 10% advantage in favor of the casting.

Other large parts are regularly made in weldments because of their economy. Recently, we produced a part wherein the casting would have weighed approximately 19,000 lb; the weldment weighed 15,400 lb. In this case, it would have taken a lot of 12 castings to equal the economy of the weldment.

To Sum It Up

Well, what does this analysis show? First, that every weldment or casting is a specific problem. Second, that in almost every case cited, a weldment is more economical in quantities of 1 to 5. This is primarily due to necessity of pattern equipment to produce castings. However, the man-hours required for casting alone are generally much less than those needed for a weldment, and the basic material price is less for castings than for weldments.

We can only conclude that there exists a real field for weldments in the field of special machinery produced in limited quantities.

NEW SUBWAY CARS

(*Continued from page 27*)

maximum force on the welding tips is 8,000 lb.

The underframes, sides, ends and roofs are assembled together in the subway car assembly shop. This shop is capable of assembling two subway cars in one 8-hour shift, using eight car-building positions. The underframes and ends are assembled and welded in this shop. The roofs and sides are completed elsewhere, transported to the car-building position and lifted in place by 10-ton cranes for assembly to a subway car.

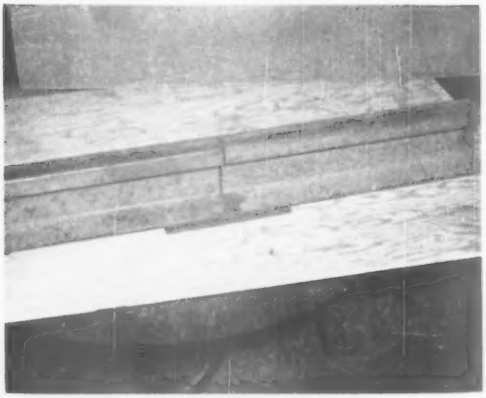
The cars follow a scheduled production line. The shop's normal complement is eight cars, moving two car positions per day. The cars are cleaned, the sides are checked for alignment, all cars are water tested for leaks, and insulation is applied to the inside. In one main subassembly line, roofs are assembled and riveted on rigid jigs to insure uniformity of size when they are transported to the car-building shop. Further along, the sides are fitted on jigs and are tack welded together and ground smooth prior to being moved to the spot-welding machine previously described.

At the end of the shop, doors and floor sheets are cleaned and painted. The doors, of aluminum spot-welded construction, are dipped in paint to insure a complete coat on the inside of the door. Each car requires twelve side doors (two to each of the six openings), two end doors and two cab doors.

Finishing Operations

The next building houses the car-finishing department, where the greater part of the work required in the completion of a subway car is done. A few of the operations performed are: apply and rivet truss floor; apply air brake valves, cylinders and piping; apply junction boxes and electrical conduit; apply electric switch boxes, resistors, shunts; apply electrical wiring, control boxes and cab control equipment; apply wire ducts and concealed inside wiring; apply inside finish and seat supports; apply doors and door-operation mechanism and control equipment; test concealed wiring circuits; prepare cars for the paint and trim department.

In the paint and trim department, the subway cars are completed by the application of windows, signs, lights and light fixtures, stanchions, seats and seat backs, heater grills, marker lights, windshield wipers and many other items of trim. The cars are painted inside and out, are completely tested mechanically and electrically, then cleaned and prepared for shipment.

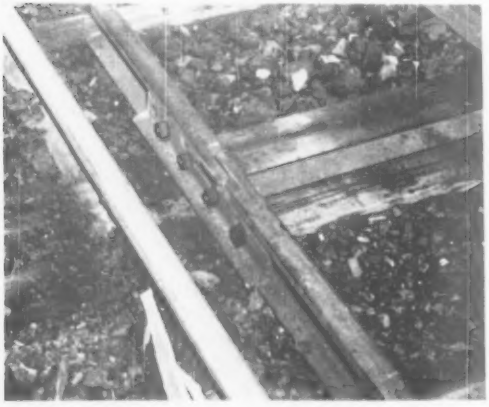


1—PROPER SPACING and alignment for a good joint. A gap of about 1/8 in. is left between the rail ends

2—PROPERLY BEVELED joint for brazing has angle of 22½ deg on each rail. Note back-up plate at bottom

3—FLANGES of rails are brazed to each other and to ¼-in. back-up plate. Braze is continued up to the web

4—BALL OF RAIL is brazed following completion of brazing depicted in Fig. 3. Above is a finished joint



5—EXPANSION JOINT, designed to meet temperature changes of outside track, isn't necessary underground

6—BRAZED JOINTS mean better conduction of rails in an electrified haulage system of a large coal mine

Brazed Joints for Mine Rails

Minimum conduction through brazed joints makes them a good bet for mine rails, which usually carry a 250-volt direct current. All that is needed is an oxyacetylene welding and cutting outfit plus rods

ELECTRICAL resistance of mine rails is of prime importance when 250-volt direct current is used—the universal condition in mines. Standard practice has been to bond all bolted joints with one or more copper bonds. However, independent engineering studies made on relative resistances of various types of joints have shown that the resistance of the rails can be reduced to a practical minimum by brazing the joints.

Smoother Rolling, Too

There are other important advantages:

(1) Brazed track provides smoother rolling action for locomotives and coal cars. Vibration and coal spillage are reduced. There is less wear and tear on axles, motor housings, mine car wheels and bearings.

(2) Troubles from low or loose joints, associated with standard bolted connections, are eliminated.

(3) Track maintenance is reduced since there are no angle bar bolts or copper bonds to be replaced. Overall track maintenance is reduced because welded track is more rigid and requires less resurfacing.

(4) Brazed track permits safer and faster main line haulage. In some cases, main line haulage has been increased 50% with fewer accidents occurring.

(5) The advantages of brazed track can be obtained at a cost comparable to that for the angle bars, bolts and labor required with conventional bolted track.

For brazing mine rails, all that is needed is an oxyacetylene welding and cutting outfit, suitable bronze welding rods and flux, and steel backup plates. The portable outfit is taken to the immediate location of the proposed joints, and the brazing is performed during periods when the track is out of service. Under normal operating conditions, eight to ten joints can be made during an eight-hour day by a welding operator and a helper.

Spacing and Preparation

The proper spacing and alignment required for a good brazed joint are depicted in Fig. 1. Approximately $\frac{1}{8}$ in. between rail ends is considered to be the ideal spacing.

A $1\frac{1}{4}$-in. steel plate approximately 8 in. long and of about $\frac{1}{2}$ in. greater width than the flange of the rail is placed immediately under the joint. This plate serves two purposes: (*a*) to increase the strength of the weld; (*b*) to serve as a back-up for starting the weld when the rail ends are spaced too far apart. When old track is to be brazed, wide spacing is quite often encountered.

Good alignment should be maintained between the rail ends by suitable clamps. Needless to say, plate and rail surfaces in the weld area should be free of all loose scale and dirt prior to welding. A small electric grinder equipped with a wire brush can be used for cleaning the rail ends of loose scale and dirt.

Preparation is an important factor in making a good brazed rail joint. The rail ends are prepared by beveling them with a cutting torch to form a $22\frac{1}{2}$ deg bevel on each rail. This beveling can be done either before or after the rail has been placed in position. Following the beveling, the rails are properly aligned and leveled, and the track is ballasted in permanent position.

A joint that has been properly beveled with an oxyacetylene cutting torch is illustrated in Fig. 2. The vee at the intersection of the web and flange was made wider to permit bonding with the $\frac{1}{4}$-in. steel back-up plate.

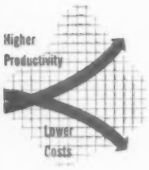
A partially brazed joint appears in Fig. 3. The procedure is to first braze the $\frac{1}{4}$-in. plate to the flange of the rail. Two adjacent rail flanges are then joined. The braze is continued up the web to the root of the ball, and the procedure is repeated on the reverse side of the rail. Upon completion of this brazing, the ball of the joint is brazed as shown in Fig. 4.

Expansion Joints

The majority of this type of welding has been performed on underground track exposed to uniform temperature the year 'round, thus eliminating problems of track expansion and contraction. With outside welded track, allowance must be made for expansion and contraction with temperature changes. Fig. 5 shows a typical expansion joint that can be easily prepared with a cutting torch. Normal spacing for these outside expansion joints is one every 300 to 400 ft depending upon track curvature.

Approximately 60 miles of mine track, ranging in weight from 40 to 90 lb, have been brazed since 1938 to form continuous track for main line haulage in the West Virginia and east Kentucky coal fields. These main haulage lines vary in length from $\frac{1}{2}$ to eight miles. Brazed joints in daily service after as long as ten years still reveal no indication of failure.

Photos and data courtesy of The Linde Air Products Co.



Design Considerations in Resistance Welding—I*

Design for resistance welding should represent the coördinated efforts of engineering, tooling, production and sales. A few things that the designer must know to do his job right are discussed here

BY WALLACE A. STANLEY

IT IS a known fact that from a group of engineering students trained in the same basic engineering subjects, in the same classes, will come designs of widely dissimilar characteristics. The difference in such designs represents the application of imagination and its adaptation to basic design practice. The greatest strides will come from "imagineering" in new ideas and concepts.

KEEP THESE IN MIND

Before embarking upon either a new design or a redesign for resistance welding, the designer should outline in order of their importance the various requirements of the product. Such an outline might be:

(1) Appearance and styling.

(2) Required strength.

(3) Usage and "abuseage" that will probably be encountered. Include operating temperatures, humidity, light, wear, corrosion, pressure and other conditions that will be encountered in service.

(4) Materials acceptable.

(5) Tolerances and limits. Include: (*a*) permissible and (*b*) necessary.

(6) Expected production, both actual and potential.

(7) Standardization and minimum possible variation of: (*a*) sizes, (*b*) types, (*c*) interchangeability and (*d*) units or models.

Appearance and styling are usually predetermined by the sales department and top management. It is easily possible to maintain the appearance and styling specified and produce a satisfactory product by any of several distinctly different methods of manufacture. In many cases resistance welding greatly enhances appearance and styling.

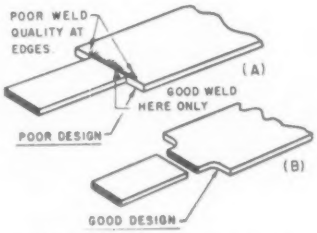
The strength of the product may be specified in many ways according to the stress—tension, compression or torsion—involved in the use of the product. The substitution of mild steel for cast iron *of the same strength* can eliminate from a structure one-half its weight. Conversely, the same structure may be designed for twice the strength without increased weight.

Temperatures at which the product is to be used are important in resistance welding inasmuch as the design of the welds should take into consideration the expansion and contraction that will normally take place under operating conditions. If such factors as corrosion and humidity are of great importance, consideration should be given to watertight and gastight joints such as are provided by either flash or seam welding or by the several methods of sealing of parts joined together by spot or projection welding. Where severe wear or frequent replacement is normal, consideration can best be given while the product is still in its "thought" stage.

MATERIALS ACCEPTABLE

It would be advantageous to acquire as good a working knowledge as possible of the weldability of similar and dissimilar metals. For example, the lack of weldability in joining lead and steel is very marked as compared with a product made entirely of steel or one made of steel and nickel or steel and stainless steel. The weldability of specific metals will be discussed in Part II.

Limits and tolerances should be



GOOD AND BAD preparation for flash-butt welding parts of unequal width but of identical thickness

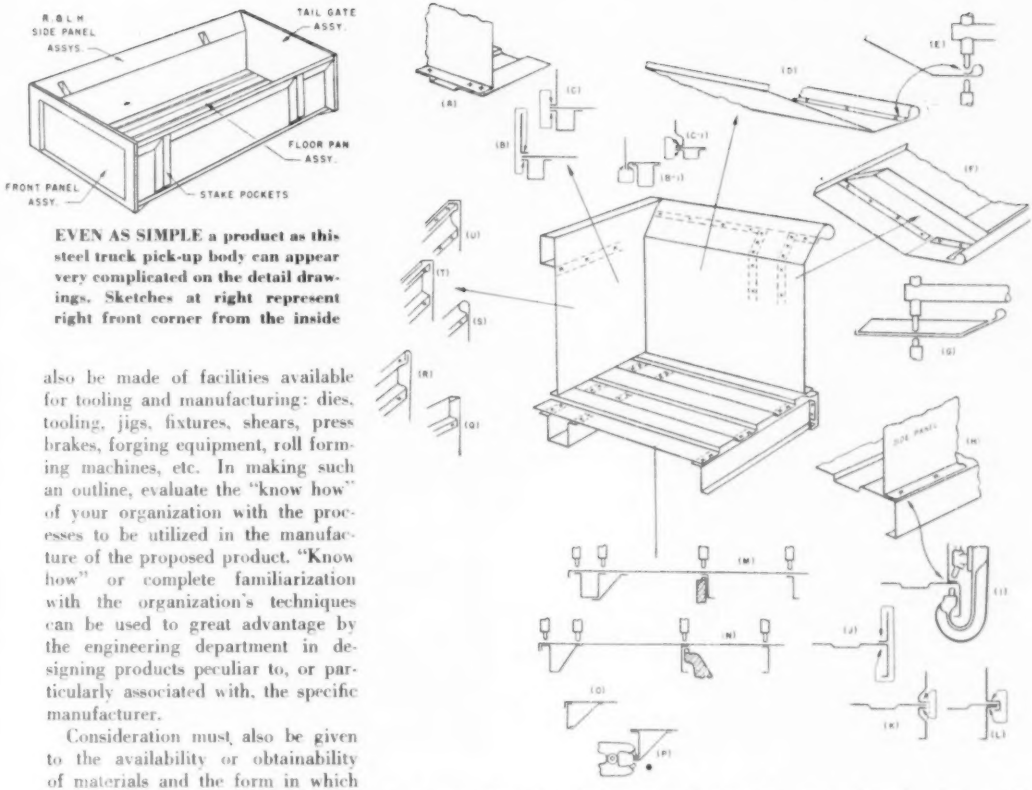
itemized in the design stage so that tooling and the welding processes may be considered thoroughly with regard to what limits are "permissible" and what are *necessary*.

The difference between the figures of *actual* and *potential* production often change the design. "Actual" production might be handled on small standard spot welders whereas "potential" production, if realized, would call for large automatic special machines. A different design might well be needed in the latter case. If potential production receives sufficient consideration at the design stage, the final design and tooling will SAVE money instead of COSTING more. The consideration given to standardization and interchangeability and minimum variations in sizes and types can result in important cost savings.

Sizes and types are usually specified by the sales department. However, the engineering department can point out how additional savings may be achieved through standardization or interchangeability of parts. Generally, this type of information can only begin in the preliminary phase of design.

Interchangeability is, of course, highly desirable so that the production of various component parts can be made in the greatest number at minimum cost. An outline should

*From Chapter 8 of "*Resistance Welding—Designing, Tooling and Applications*," a new book to be published shortly by the McGraw-Hill Book Co., Inc., New York City.



EVEN AS SIMPLE a product as this steel truck pick-up body can appear very complicated on the detail drawings. Sketches at right represent right front corner from the inside

also be made of facilities available for tooling and manufacturing: dies, tooling, jigs, fixtures, shears, press brakes, forging equipment, roll forming machines, etc. In making such an outline, evaluate the "know how" of your organization with the processes to be utilized in the manufacture of the proposed product. "Know how" or complete familiarization with the organization's techniques can be used to great advantage by the engineering department in designing products peculiar to, or particularly associated with, the specific manufacturer.

Consideration must also be given to the availability or obtainability of materials and the form in which these materials are available. If complete freedom of choice of materials is allowable, there will be no restraint placed on design.

Need Coordinated Thinking

It cannot be stressed too greatly that by preliminary engineering work many improvements and cost reductions can be accomplished at the design stage. In far too many instances, the engineering department deems itself self-sufficient and completely detached or divorced from the manufacturing department. Under such circumstances, tooling departments are apt to cast reflections upon engineering and wail loudly that they were not consulted in certain operations and that certain designs cannot be made as specified on the blueprints. Manufacturing may feel that both designing and tooling are "off the beam" and that *it* should have been consulted before the design was frozen.

Tool design can offer valuable suggestions due to intimate knowledge of its particular job, which is to tool the products for manufacture. Specialists on tooling can provide the designer with guides or suggestions that will surely cut tooling costs. The manufacturing department can also contribute the same type of help, advice and guidance based upon a totally different outlook; *i.e.*, the techniques of good manufacturing practice.

One large corporation which tried joint consultation of designing, tooling and manufacturing departments immediately achieved 53 very sound engineering changes which would otherwise have been overlooked on a product about to be released. Greatly increased efficiency, a far superior product and a considerable saving in tooling costs resulted.

Eleven Commandments

Here are a few "rule-of-thumb" suggestions that can prove of assistance when the actual formation of design ideas is underway:

(1) List the daily or hourly production required and calculate the length of the production run.

(2) Use special alloys only where necessary and specify materials of the best possible weldability.

(3) Keep the welding *technique* in mind—not merely the welding.

(4) Get a mental picture of the type of equipment with which the product is to be made.

(5) Incorporate processes and techniques into your design that will provide as good fit, matching or location of parts as is obtainable. Do not specify more resistance welding than is actually required; for example, using four welds when three will suffice.

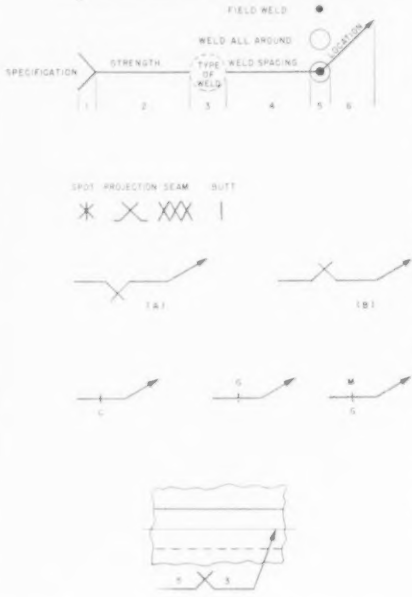
(6) Use as few parts as possible in composing the welded structure.

(7) Incorporate only the handling requirements absolutely necessary.

(8) Reduce or eliminate, wherever possible, machining or similar operations.

(9) Carefully analyze the possibility for attaching small, easily machined parts to larger assemblies by welding.

Symbols for Resistance Welding



1—BASIC characters for the four chief resistance-welding processes and the fixed positions for specification data are given in the two upper sketches. Sketch (A) indicates a projection weld on the near side (below line) and (B) one on the far side. Letters C, G and M designate a mechanical finish after welding by chipping, grinding and machining, respectively. Bottom sketch shows how weld strength (on the left) and spacing (right) are specified for a projection weld

(10) Joint designing should be well balanced for all stresses.

(11) Review joints from both a stress and tooling viewpoint and hold requirements of operator's skill to a minimum. Study joint designs to determine proper equipment to be used.

Resistance-Welding Symbols

One of the seemingly small details that add up to better design is the constant and general use of resistance-welding symbols on all design or detail drawings specifying the use of any of the processes. To simplify the problem of conveying all of the required information from design to tooling and to manufacture, the American Welding Society has developed a complete system of symboling, in turn adopted by the American Standards Association. These symbols can become a universal language, equally understandable in all departments and at the hands of all personnel having to do with the design, tooling, manufacture or sale of the product.

The symboling is quite simple, being based upon an acknowledged character for each of the four chief processes: spot, projection, seam and butt welding (Fig. 1).

Roll-spot welds, while made on a seam-welding machine, are still spot welds and are so indicated by the use of the spot-weld character. The projection-weld character is also used to indicate cross wire and ridge welds.

Using one of these characters as a center or focal point, an arrow is projected through it directionally pointed to weld placement. Along the tailing length of the arrow all other information normally required is organized in fixed positions.

Position 1 in the top sketch of Fig. 1 is a variable which is used only where it is necessary to make reference to some shop specification which cannot be set out in detail as a part of the symbol. Such references to specifications as are required are placed within the fork of the tail, and that fork may be placed either to the right or the left of the process character, according to placement of the arrow head.

The arrow head (position 6) is placed at right or left of the process character as weld location requires and may be turned up or down for proper relation to weld placement.

Position 5 is used for a "weld all around" symbol (an open circle) and/or a "field or outside weld" symbol (solid circle). A "field or outside weld" is generally a weld to be placed at a later stage than that shown in the particular detail drawings.

Positions 2, 3 and 4 are fixed; 3 is the process character, 2 the strength specification (always at the tail side of the process character) and 4 the weld spacing, given at the arrow head side. The number of spot or projection welds in any given line or sequence are shown in parentheses directly below the weld character.

Spot and projection weld shear strength is always shown in units of 100 psi per weld. Seam-weld shear strength is shown in the same manner per lineal inch of the weld, while butt and flash welds are shown in 100-psi units of tensile strength.

If projection welds in joints parallel, or nearly so, to the plane of the paper are to be made with projections on the near side, the indication is to place the projection weld character below the main line of the symbol (sketch A); if on the far side, above the line (sketch B). In a projection-welded joint shown in section or end view, the member with projections is indicated by pointing the arrow to it. The weld character goes below the line.

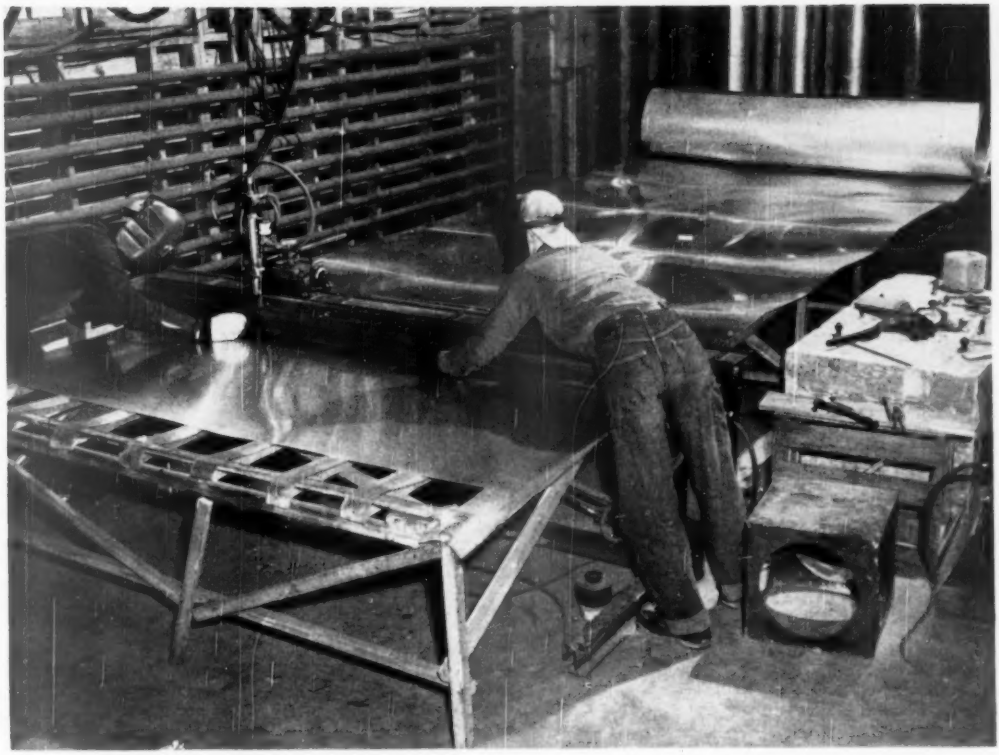
If welds are to be made without surface marring, indentation or burning, a short horizontal line is placed either above or below the weld-process character: *below* indicates the near side, *above* the far side, as the surface to be flush or unmarked.

Where welds are to be mechanically finished by grinding, chipping or machining, the first letter of the operation designated is placed either above or below the weld-process character, as in sketches C, G, and M-G. Again, the below position indicates the near side and above the far side.

The arrow head should contact the center line of the weld or row of welds, as in the bottom sketch of Fig. 1.

When one learns these basic characters and the few simple rules, all of the required information is conveyed with a clear understanding.

Part II of this article, dealing with the weldability of various metals and alloys by resistance welding, will be published in an early issue—The Editors.



SEVEN LARGE aluminum sheets are placed on a worktable to be welded on a production basis into a roof for a —

Welded Aluminum Trailer

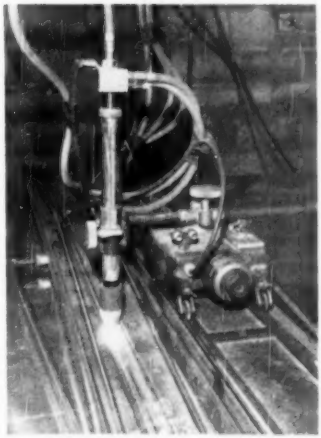
C. Loznak Co., of Flint, Mich., uses an inert-arc holder mounted on a traveling carriage for production welding of trailer roofs from 38 HH aluminum sheet, 4 ft by 6 ft 10½ in. by 0.04 in. thick

BY R. E. FERRIS
Technical Sales Division, Air Reduction Sales Co.

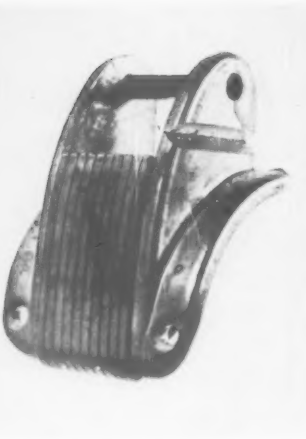
A RECENT application of the inert-gas tungsten-arc process to aluminum was made by the C. Loznak Co., of Flint, Mich., for the Mobile Trailer Co. Using a machine holder mounted on a traveling carriage, this company is fabricating aluminum trailer roofs on a production basis.

The roofs are made of 38 HH aluminum sheets, 0.04 in. thick. Each sheet is 4 ft wide and 6 ft 10½ in. long, and seven sheets are required for a roof. The sheets are placed on a worktable large enough to hold seven sheets. The carriage track is secured to the top surface of an 8-in. channel, which is located alongside the top section of the welding fixture with its flanges pointing downward. Hose and cables are suspended from overhead trolleys, where they are out of the way.

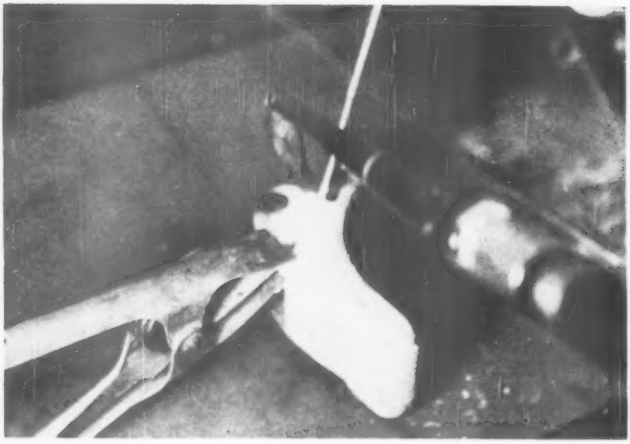
The application of inert-arc welding to this manufacturing operation has produced a saving in both time and labor. The Mobile Trailer Co. is pleased with the results being achieved and has found that the inert-arc-welded trailers are superior in both quality and appearance to those formerly produced.



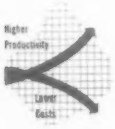
INERT-ARC head is mounted on traveling carriage. Track is secured to an 8-inch channel; hose and cables are suspended overhead



1—BEVELED edges prepare a part



2—REDUCING FLAME is used to weld part, a refrigerator door handle



How to Weld

White metal is another name for the zinc-base alloys used to make die castings. Contrary to the opinion of many weldors, a broken die casting can be welded, and it will have the same strength as before

BY ROLAND H. OGDEN

President, Aladdin Rod and Flux Mfg. Co., Grand Rapids, Mich.

EARLIEST use of die castings was confined almost entirely to the manufacturing of toys and items for ornamentation because of the poor physical properties of the product. Through the coöperation of machine tool engineers, metallurgists, product designers and die-casting engineers, die castings have now become a widely used medium for the translation of ideas into material form. The acceptance of zinc-base alloy die castings for highly stressed functional parts has become so widespread that few people realize, and even relatively few engineers are aware of, the extent to which they are used.

From Aircraft to Zippers

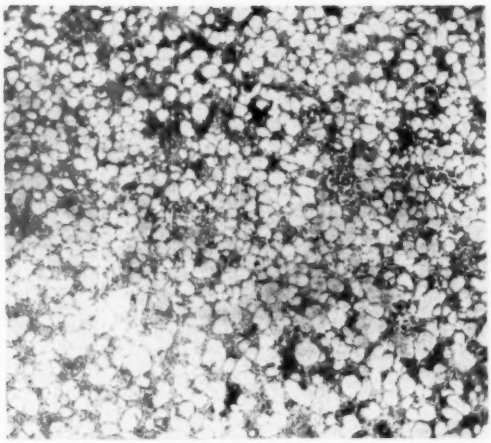
To mention a few of the many uses to which die castings have been applied, we see such diverse items as typewriter frames, aircraft instrument parts, railroad signal devices, toys, machine tool frames, gears, automobile parts and food mixers. We must not forget to mention that most important functional article—the zipper. It does seem a little incredible that so many uses have been found for a medium that appeared to have so little promise such a short while ago.

The reason why so much faith is placed in die castings today is because ways have been found to overcome the shortcomings of previously used methods and alloys. Your life and mine is protected and made more enjoyable by vital equipment fabricated, in part at least, from die castings. What changes have been made in alloys and methods to make such a widespread acceptance come about? Let us consider the question for a moment.

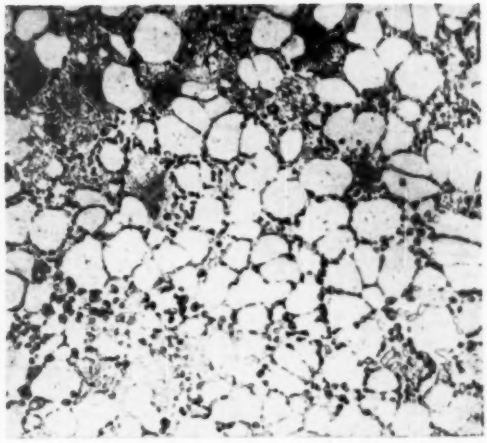
When the industry was in its infancy the product was of inferior quality. The metal was "brittle"; that is, it lacked impact strength. The tensile strength was low, and little or no elongation was to be expected. Only castings of relatively simple design could be made. In contrast to this, we can now obtain castings with impact, tensile and elongation values exceeding those of good-quality cast iron. The industry is producing castings of the most intricate design and complex coring. Die castings may be obtained ranging in size from those which make up a zipper to a recently announced product measuring 33 by $43\frac{3}{8}$ in. and weighing upwards of 10 lb.

Failure Means Welding

A proper question to ask at this time is, "What has all this to do with welding?" The answer appears to be obvious. Whenever a material is used to manufacture structural details and these parts are placed in service, failures are bound to occur. Failure may be caused by a faulty design, imperfect workmanship, abuse or a number of other reasons. It also appears reasonable to expect that more and more failures will take place as more and more parts are made and put into service. It is not axiomatic, however, that the percentage of failures will rise. On the contrary, the percentage of failures will decrease because the designers will have



3—WELD at 100X is little different from base metal



4—AT 500X the eutectic component is well defined

"White Metal"*

gained experience in the use of the material.

Suppose failure of a functional part takes place in a zipper or a machine part. We are not going to suggest that you attempt to weld a zipper; that sort of repair work can well be left to other artisans. We do suggest, however, that the repair of gears, machine parts and a host of other products does fall within the weldor's province. A welding shop, by applying the proper technique, can make satisfactory repairs on zinc-base alloy die castings.

That the idea is still prevalent among weldors that white metal or, more properly, zinc-base alloy cannot be welded is not too surprising. There is a dearth of written information on the technique of making satisfactory welds. A search of the literature published in the German, French, Russian and English languages brings to light less than 15 papers on the subject to date.[1-6] In contrast to this, an article by Spraragen and Claussen[7] covering the period up to June 1, 1939, lists 124 references relative to the welding of the light metals. The literature covering the welding of light metals has grown considerably since 1939.

Getting back to the welding of "white metal," if a part breaks it has to be repaired or replaced. Sometimes, through obsolescence, the part cannot be replaced. Welding offers the ideal way of repairing the fractured casting. The pitfalls that beset a person who attempts to solder a die casting are well known. When the parts are fastened together by soft soldering, the strength of the joint will be very deficient, probably to the extent of being useless. Welding, properly done, will leave the parts as strong structurally as they were when made. The welded castings can be given the same finish they were given at the time of manufacture. Furthermore, they will give just as good service and as long life as a new part.

Composition of Alloys

Before a successful weld can be made in any material, some knowledge must be acquired concerning the composition of the base metal. Table I shows the chemical composition of six of the zinc alloys most used by industry today. The compositions shown probably cover 98% of the metal used by the die and slush casting industry in this country and abroad. Only two of the six alloys listed find widespread application at the present time. Alloys listed under the second and third columns have the greatest use, with No. 1 alloy finding use for special purposes and to a limited extent.

The composition of a well-known welding rod used in welding zinc-base alloy die castings is shown in Table II. It will be noted that this analysis conforms very closely to that of alloy 1 as shown in Table I.

Experience has shown that certain advantages are to be obtained by the use of the alloy shown in Table II. This alloy, a ternary alloy of zinc, aluminum and copper, tends to be finer grained under the torch flame. Being almost of the composition called for by the ternary eutectic[8], this alloy has the lowest melting temperature of any possible combination of its three major constituents. The liquidus or freezing-point temperature is approximately 707-710 F. Assuming that the casting metal has a solidus or melting-point curve of 716.7-717.1 F and a liquidus of 727.0-727.9 F[9], we can with some reasonable assurance expect complete fluidity of the filler metal when the base metal is at the mushy stage.

Sober thought will tell us that normal variations in composition are to

*Abstract of a paper presented at the 30th annual meeting, American Welding Society, Cleveland, week of Oct. 17, 1949.

Table I. Chemical Composition of Zinc-Base Alloys

	Alloy No.					
	1	*2*	*3*	*4*	*5*	*6*
Commonly used domestic and foreign names	Zamak 2 A.S.T.M. XXI S.A.E. 921 Mazak 2 Gomak 2 GM-4128-M	Zamak 3 A.S.T.M. XXIII S.A.E. 903 Mazak 3 Gomak 3 GM-4130-M QQ-Z-363	Zamak 5 A.S.T.M. XXV S.A.E. 925 Mazak 5 Gomak 5 GM-4129-M QQ-Z-363	Zamak 6	Zinc base Slush casting alloys	Zinc base Slush casting alloys
	Composition, %					
Aluminum	3.5-4.5	3.5-4.3	3.5-4.3	4.10 nom.	4.50-5.00	5.25-5.75
Copper	2.5-3.5	0.10 max.	0.75-1.25	1.25 nom.	0.20-0.30	0.10 max.
Magnesium	0.02-0.10	0.03-0.08	0.03-0.08	Not spec.	None	
Tin	0.005 max.	0.005 max.	0.005 max.	Not spec.	0.005 max.	0.005 max.
Lead	0.007 max.	0.007 max.	0.007 max.	Not spec.	0.007 max.	0.007 max.
Iron	0.100 max.	0.100 max.	0.100 max.	Not spec.	0.100 max.	0.100 max.
Cadmium	0.005 max.	0.005 max.	0.005 max.	Not spec.	0.005 max.	0.005 max.
Nickel	0.050 max.	0.050 max.	0.050 max.	Not spec.		
Pd-Cd-Sn	0.010 max.	0.010 max.	0.010 max.	Not spec.		
Zinc	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder

Table II. Filler Rod Analysis

Element	*Composition, %*
Aluminum	4.15
Copper	2.97
Magnesium	0.045
Tin	0.001
Lead	0.002
Iron	0.045
Cadmium	0.002
Antimony	Nil
Zinc	Remainder

be expected in both the base metal and the filler rod. Hence an allowance should be made for a deviation from the theoretical melting points. By exercising every possible precaution during the melting and alloying of the filler rod metal, the composition is held to a very narrow range of variation. Repeated tests on various heats of metal alloyed for making welding rod, using calibrated thermocouples and potentiometers, indicate a melting-point spread of approximately 5 F. Such a small range is thought to be quite unusual.

Provide a Support

In applying any theoretical figures relative to melting points to practical problems, we must use caution and be alert to the unexpected. In this way many pitfalls and failures will be avoided. It must be recognized, for instance, that there will be cases where the base metal will have the same or almost the same melting point as the rod being used. When this condition exists, some support must be provided under the weld. Since the weldor will never know when he is going to run into this situation, he should always provide the support before he starts applying the torch flame to the work.

Metallographically, we are fortunate in that the component constituents arrange themselves, under the influence of heat, in such a way that the low-melting eutectic is formed first. They also use up all of the available elements to form the maximum amount of this eutectic. This property of metals makes it possible to get the homogeneity evidenced in the photomicrographs shown in Figs. 3 and 4. These photomicrographs were taken of structures obtained when the commercial die casting shown in Figs. 1 and 2 was welded under ordinary shop conditions. The part illustrated is a refrigerator door handle.

Particular attention should be given to Fig. 3. This photomicrograph, taken at a magnification of 100 diameters, shows a barely discernible line of demarcation between the weld metal and the base metal. The only noticeable effect is a slightly smaller grain size in the weld metal and a decrease in porosity. The larger white areas are the solid solution constituent, which is more prevalent in the parent metal as is to be expected from its analysis. The ternary eutectic, the feathery looking stuff, is very much more pronounced in the weld metal. Figure 4, taken at 500 diameters magnification, shows the eutectic quite clearly.

Getting down to the actual mechanics of making the weld, we have to face certain facts. First, the temperature range within which we must work is rather narrow. The range amounts to about 18 to 20 F. The nature of the alloys is such that if the temperature throughout the casting approaches the solidus (melting-point curve), the whole casting will collapse into a pool of molten metal. Fortunately, the alloys used to make die castings are relatively poor conductors of heat, the volume conductivity relative to copper being approximately 27%.[2] Die-casting alloys are prone to the formation of tough, tenacious oxides when subjected to elevated temperatures, a property which can be both advantageous and exasperating.

Planning a Procedure

With some ingenuity we can bend to our will all of these various properties, both advantageous and perverse. For instance, these alloys have a melting range rather than a sharp melting point. This property enables us to tell when the parent casting metal is at the proper temperature to start welding; the trick is to look for the first molten metal which appears on the surface.

To keep the whole casting from collapsing, advantage is taken of the heat conductivity of the casting alloy. By combining the property of poor heat conductivity with flame manipulation, we can more or less control the heated zone.

The formation of a tough, tenacious oxide film is made to work for us through its tendency to support the mushy metal during the welding process. The oxide film must, however, be punctured by the filler rod and must be removed from the im-

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He checks every piece of mechanical equipment he owns for wear, lubrication, efficiency.

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mediate vicinity of the molten metal in the weld zone, or porous welds having areas of incomplete fusion will result.

The preparation of the fractured surfaces for repair by welding is of prime importance. All foreign matter of any origin must be removed. This matter may consist of chrome or nickel plating, paint, grease, oxides or any number of other things, and it may be removed by grinding, filing, dissolving with suitable solvents or by other expedients. After the casting has been cleaned, the break is veed to an included angle of 45 deg. The vee should extend all of the way through the casting under normal circumstances. The prepared edges are then scratch-brushed.

If the casting is large and complicated, preheating of the whole structure is recommended[1] to approximately 240 F. We must remember that the zinc alloys have a rather large coefficient of expansion, and any localized heating may well cause serious distortion.

Use a Reducing Flame

Consideration of the adjustment of the torch flame should next occupy our attention. We are already cognizant of the propensity of the zinc die-casting alloys to form oxide films at relatively low temperatures. To prevent, or at least help to prevent, the formation of such oxides we must have a reducing flame, produced by using an excess of acetylene. A soot-forming condition must be avoided at all times, however. Experiments indicate that the correct adjustment is when the inner cone is white and slightly bushy.

A No. 1 or No. 2 tip is adequate for most jobs. A larger tip may be required, however, when repairs are to be made on large Kirksite die blocks or work of a similar nature. It is well to remember that the metal is weak and without much strength when at the correct temperature for welding. Therefore a soft, lazy flame is to be preferred over one which is noisy and of high velocity. The high-velocity type of flame is likely to blow through the metal being worked upon. Pressures at the gauges of 2 psi for oxygen and 4 psi for acetylene appear to be about right. A slightly higher oxygen pressure may be required at times to eliminate the sooting tendency of the flame.

As welding starts, the torch flame should be applied to the work in such a manner that a small spot is heated until the metal begins to flow. The torch is then turned sideways so that the flame is almost parallel to the line of weld in both the vertical and horizontal planes. Remember that thin oxide coating over the molten metal! The end of the filler rod is thrust through the oxide film covering the base metal so that, with the help of a continual puddling action with the end of the rod, the filler metal may be made to flow into the weld. The method of flame adjustment and manipulation relative to the welding of die castings and "white metal" is covered in U. S. patent number 2,055,360.

Spatula Shapes Metal

To utilize another property of zinc alloys, that of the mushy stage, a small spatula is required. This is made by hammering out the end of a steel or, preferably, Tobin bronze welding rod and suitably rounding it. The mushy-stage property is helpful when building up bosses, square edges and around holes. First, we must build up a mass of metal around the place we wish to enlarge or shape. The surface tension and the oxide film will tend to make the mass of metal take on a rounded contour. By heating the whole mass to the temperature where it is just mushy, we can shape or trowel, if you please, the metal into the shape or form that is desired.

After welding, the broken part should be ready to be returned to service except, possibly, for some machining or refinishing. If an excess of metal is deposited, the surface can be dressed down by filing, grinding, machining, etc., so that a smooth, even profile will result. After the welded surface has been prepared to match the surrounding area, the part can be refinished exactly like the original finish.

Six Points to Remember

To sum up the pertinent points:

1. Clean the metal around the failure very carefully, removing any plating, paint or grease.

2. Vee out the metal to an included angle of approximately 45 deg along the line of fracture where the weld metal is to be deposited.

3. Careful attention should be paid to the adjustment of the torch flame. A soft, lazy flame is best for successful welds.

4. Apply the torch flame to the work properly. Rather good control of the weld-zone temperature may be exercised by proper manipulation of the flame.

5. Apply the welding rod so as to facilitate the flow of metal under the oxide film. The oxide must be prevented from being stirred into the weld zone.

6. Scrap material is wholly unsuitable for filler metal, and its use can only result in inferior welds.

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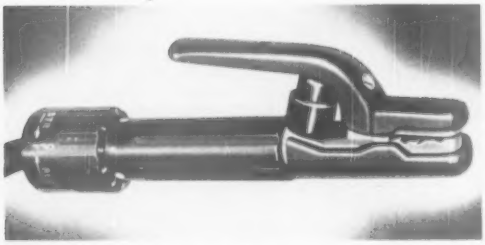
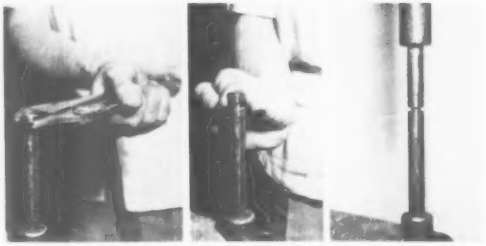


REMOTE CONTROL for d-c welders selects straight or reversed polarity, stops and starts welder, adjusts heat to work needs



WORN INSERT on electrode tip removed with pliers (left). New insert put in shank (center). Other tip pushes insert into place (right)

Welder Remote Control

REMOTE control device for a-c motor-driven d-c welders makes it possible to start and stop the welder, select polarity and regulate current from a distance. All machine controls are at the rear of the electrode holder. The additional weight on the holder is only 3 oz.

The device consists of two parts: the control box, housed on the welder, and a standard holder equipped with a special grip. Connection between the holder controls and the control box is maintained by three No. 20 wires rope-spiraled along the work cable. A special inexpensive connector is provided to splice in additional lengths of cable. The average electrician or maintenance man can probably install the device in an hour or less, states manufacturer.

The electrode holder itself is a standard popular make and is replaceable. Two control knobs are located at the back of the holder grip. One of these actuates a double throw switch, which determines straight or reverse polarity depending on the direction the switch is thrown. The other knob is calibrated to adjust the heat in a smooth stepless control. There are no moving parts other than the knobs on the handle and the relays in the control box.

For straight-polarity downhand welding, the control covers almost the entire heat range with one setting of the machine, maximum down. For reverse-polarity requirements, the machine is set for the largest electrode size, with the machine voltage control full on. The new control then covers not only the rod size selected but the next two smaller rod sizes as well.

At present the equipment is available for Lincoln 200, 300 and 400 amp machines in several models and a Hobart 300-amp machine. Early in 1950 it will be available for all popular makes and sizes, including engine-driven equipment.

FOSTER TRANSFORMER CO., 3820 Colerain Ave., Cincinnati 23, O.

* * *

Flux Formulas

FORMULAS for making your own fluxes are offered by R. N. ROBBINS, 288 Montgomery St., Bloomfield, N. J. Fluxes for welding or brazing sheet steel, copper, aluminum, cast iron and other alloys are among those offered.

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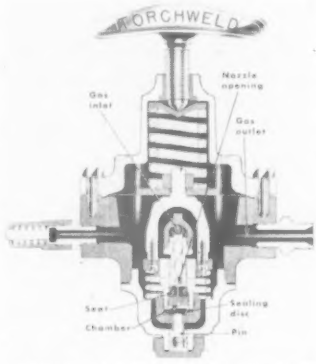

CONSTANT gas pressure despite lowering cylinder pressure is claimed for regulator

Constant-Pressure Regulator

CLAIMED to maintain constant volume and pressure of welding gas without requiring two-stage reduction, the new Torchweld "6500" incorporates a pressure-compensating unit that counteracts the effect of decreasing cylinder pressure. Heretofore, according to NCG engineers, only the two-stage regulator with its relatively complex structure has been able to maintain constant delivery pressure.

The new pressure-compensating unit consists of a small gas chamber below the valve seat, a reinforced-rubber sealing disk at the bottom of the chamber and a pin resting between the disk and the back cap of the regulator.

Gas at cylinder pressure is admitted to the chamber through an orifice in the movable valve seat. As supply pressure decreases, pressure of the gas in the chamber results in an action which moves the seat gradually away from the nozzle, permitting a constant rate of flow to be maintained.

NATIONAL CYLINDER GAS CO., 840 North Michigan Ave., Chicago 11.

Replaceable Electrode Tips

CLAIMED to save time and money in quantity operations, replaceable inserts for spot-welding tips are held in place in a special shank of tapered design. The worn inserts are removed with narrow-nose, vise-grip pliers which have been reground to 60 deg. The new insert is placed in the shank and forced into place by the pressure of the spot welder. Total changing time is said to be only a few seconds as compared to five minutes or so by the conventional method.

Each shank will outlast a dozen or more tips, maker claims. Tip costs approximately one third of the price of the shank and tip combined.

SMITH BROTHERS MACHINE SHOP, 5304 Banks St., San Diego, Calif.

* * *

UNOBSTRUCTED vision for gas welders offered in adjustable plastic welding mask

Gas Welding Mask

MAIN feature of a new mask for gas welding, cutting and brazing is a wide rectangular lens giving unobstructed vision. The new mask, called the Jackson type BX, may be worn over prescription glasses.

The headgear and cross strap over the top of the head are made entirely of moistureproof extruded plastic. They will not shrink or warp and may be thoroughly sterilized. The headgear pivot assembly is semipermanent, with tension locked in at

for welding

Higher Productivity / Lower Costs

Replaceable tip inserts for spot welders, remote control for d-c welders, single-stage constant-pressure regulator and gas weldor's mask with large lens are 1950 cost-savers for the welding industry

the factory. The side protectors hold the pivoted lens retainer, which is made of opaque molded plastic.

Lenses are available in shades 3 through 6. They are held securely in place but may be easily replaced.

GENERAL SCIENTIFIC EQUIPMENT CO., 2700 West Huntingdon St., Philadelphia 32.

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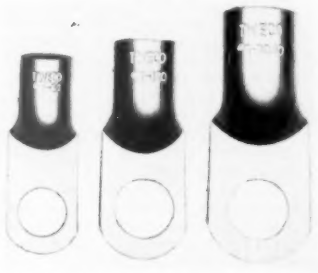


AMPLE CLEARANCE for wing nuts, large stud holes are feature in Tweco cable lugs

Copper Soldering Lugs

TWECO is offering new copper soldering lugs designed specially for welding cables. Larger stud holes and ample wing nut clearance are two advantages. The lugs are made from high grade electrolytic seamless copper tubing. The tang is solidly impacted to prevent solder leakage, and its contact surface is smooth and flat.

Three sizes of lugs take in the range of welding cables from small size No. 6 to large No. 4/0.

TWECO PRODUCTS CO., English at Ida, Wichita 1, Kansas.

* * *

Packaged Outfit

NEW oxyacetylene welding and cutting outfit called "Flamecraft" will be marketed as a package. It will include a 122 cu ft oxygen cylinder, a 60 cu ft acetylene cylinder, welding torch, cutting attachment, tips, regulators, hose, goggles, cylinder truck, fluxes, an assortment of welding and hard-facing rods and an instruction folder.

The cylinders are supplied with the outfit on a lease basis for a 25-year period, the estimated lifetime period of the cylinders. Under the lease arrangement, demurrage charges are eliminated and cylinder maintenance guaranteed.

This compact outfit is expected to find many users in garages, small shops and farms.

AIR REDUCTION SALES CO., 60 East 42nd St., New York 17.

* * *

SEVEN interchangeable filters for seven respiratory hazards fit in new respirator

Fume Respirators

NEW twin-cartridge respirator, the R5000, is designed to provide protection against seven respiratory hazards through a basic face piece and seven interchangeable filters for guarding against combinations of dusts, organic vapors, acid gases, combined acid and organic gases, ammonia, organic vapors and fumes from welding and cutting.

The various filters can be quickly screwed into the twin-filter holders. Basic facepiece is molded from durable rubber and has a rolled edge that curves inward to give a snug fit. Other features are a flexible brace for shaping the respirator to the wearer's features, an efficient inhalation and exhalation system and an increased field of vision made possible by thinner filter cartridges.

AMERICAN OPTICAL CO., Southbridge, Mass.

* * *

New Hard-Facing Rod

NEW Bergstrom "Dimaloy" hard-facing rods offer twin advantages: (1) the user can insert his own choice of filler rod or particle inside the hollow tube and (2) the ferrous coating on the outside of the tube is added to the filler metal to give a deposition rate claimed to be 25% greater.

The green tipped coated unfilled tube is recommended for scraping abrasion applications such as oil field tool joints, scarfer teeth, subsoilers, cable tools, etc. Tungsten carbide particles are poured in the tube before welding, and a special packing material (included in each package) is also put into the tube. The packing material, claims manufacturer, prevents the carbides from spilling and being wasted while welding goes on. Matrix hardness is 48 Rockwell C.

The "Dimaloy" brown-tip tube is recommended for applications over high-alloy steels. A hardness of 28 Rockwell C in the matrix is achieved. Rods of cast iron, stainless, high-carbon steel, copper, manganese steel, etc., may be inserted.

INDUSTRIAL OVERLAY METALS, INC., Eaton, O.

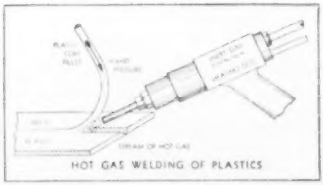
* * *

Metal Polisher

PORTABLE electric polishing and rubbing tool weighs only 4¼ lb and has a free speed of 1,300 rpm. A swivel side handle can be positioned at any point on the tool for greatest ease of handling. Balanced design is claimed to prevent tipping to cause mars or scratches.

Motor operates on 115 volts, a-c/d-c. Purchase price includes a 6-in. diameter rubber pad, a 6½-in. diameter lamb's wool polishing bonnet and a container of polish.

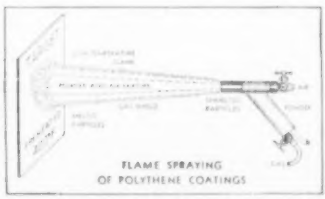
CUMMINS PORTABLE TOOLS, DIVISION CUMMINS BUSINESS MACHINE CORP., 4746 Ravenswood Ave., Chicago 40.



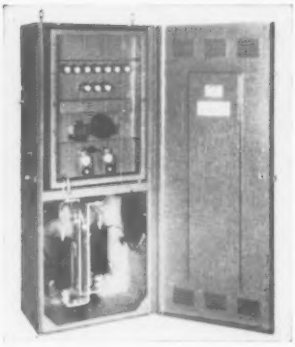
HOT GAS WELDING OF PLASTICS

Plastic Welding with Filler Rod

PLASTIC SHEETS can be welded with a plastic filler rod by a new process announced by American Agile Corp., 5806 Hough Ave., Cleveland 3. The process is said to be similar to oxyacetylene welding except that the heat is at a much lower temperature. Special guns which use heated inert gas produce a welding heat of 280 and 650 F. A flame spraying operation is also possible with a new Agile spray gun. Such plastics as Saran and Koroseal have been successfully welded



FLAME SPRAYING OF POLYTHENE COATINGS



NEW R-W CONTROLS allow use of 3-B or 5-B weld timers, precision synchronous controls, auxiliary forge-timing controls, etc.

Electronic Controls

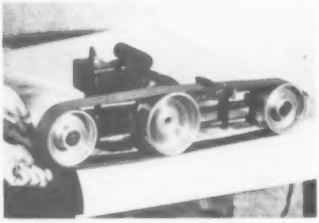
NEW high-speed resistance-welding control equipment for both synchronous and non-synchronous operation is available from Westinghouse. These controls are all-electronic: there are no moving parts in power and control circuits except initiation and solenoid relays.

Basic control panel consists of the plug-in "Rectox" rectifier tube firing panel (for non-synchronous) or a heat-control firing panel (for synchronous units). Basic controls also include the 3-B sequence weld timer for single-impulse spot welding. A precision weld-time panel may be substituted for a 3-B or 5-B sequence weld timer to provide synchronous precision control with the heat control panel.

Space is also provided for the addition of such auxiliary control panels as a-c forge timer, d-c precision-type forge timer, wave-shape control, voltage compensator, initial-squeeze attachment, current regulator, temper sequence weld timer, dual weld attachment, interlocking relay attachment, dual weld interval attachment and a "Timatic" control attachment for automatically preselecting and presetting the correct current for the thickness of metals being joined.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30.

* * *



ANY ANGLE can be set on belt of new belt grinder. Mechanism pivots on motor axis

Adjustable Belt Grinder

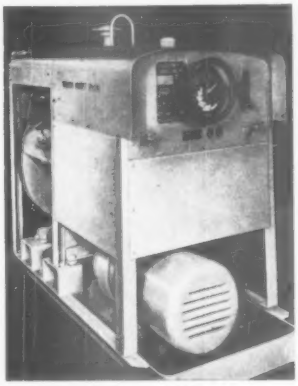
THE "Expeditor" belt grinder is mounted on an axis that centers at the motor shaft, and with one turn of a clamp nut the abrasive belt can be set at any angle.

Several "Expeditors" can be set above each other so that their contact wheels or platens will all be directly in front of the operator. In this set-up the worker can rough, semifinish and finish grind without leaving his position.

Front contact roll is made of aluminum; a drive belt serves as a resilient or cushion.

HARVEY L. RAMSAY & CO., 636 South Tenth Ave., La Grange, Ill.

* * *



IMPROVED features in engine and generator highlight new 200-amp Hornet welder

Engine-Driven Arc Welder

LATEST addition to the Air Reduction line of welders, the 200-amp Hornet "Special" is driven by a four-cylinder, 31-hp air-cooled Wisconsin engine. The generator has a welding range of 40 amp at 20 volts to 250 amp at 40 volts.

Features are: precision bearings and special provisions for keeping them dirt-free; simplified current control with wheel mounted on the panel and adjustable to five positions; self-controlled exciter for instant recovery voltage over short circuit and convenient terminals with ample space between them to prevent accidental shorting of welding cable lugs.

Engine has magneto ignition with impulse starting and hand-cranking to eliminate battery maintenance. Coupling is accomplished with a steel core V-belt.

Overall dimensions of the "Special" are 58½ in. long, 47 in. high and 25⅝ in. wide. Weight is 825 lb, equipped with a full-length drip-proof canopy and lifting eye on top. A two-wheel, trailer-type running gear, with 4-ply pneumatic tires and a 38-in. long drawbar are available as optional equipment.

AIR REDUCTION SALES CO., 60 East 42nd St., New York City 17.

* * *

Chrome-Boride Electrode

DEVELOPED for severe abrasion and corrosion-resistant applications, new chrome-boride electrode is claimed to deposit metal of 68 to 72 Rockwell C hardness as air cooled. The only finishing possible of the deposit is with grinding wheels.

Electrodes consist of a rod of high-chromium steel covered with an extruded ferro-boron coating. It is said to work well with either a-c or d-c, straight polarity. Current settings will vary from 80-100 amp on ⅛-in. electrodes to 240-280 amp on 1/4-in. electrodes. Typical applications are for crusher rolls, scarifier teeth, drill bits, dredging tools and mining equipment.

ALLOY RODS CO., York, Pa.

* * *

IMPROVED welding and brazing of cast and malleable iron is claimed for new fluxes

Brazing Fluxes

SEVERAL new Victor fluxes are offered for brazing and welding of cast and malleable irons. No. 3 is a general brazing flux for use with metal that is not too dirty or otherwise difficult to weld or braze. No. 5 (moderate heat) and No. 7 (high heat) can be used to repair metal that has paint, oil or grease on it. A special ingredient oxidizes any graphite present and otherwise cleans the metal.

Victor No. 7 is specially effective for brazing moderately burned castings when a deep fill is needed. No. 9 cast-iron welding flux is said to eliminate the viscosity in the cast-iron welding puddle which makes it hard to work out gas bubbles. This flux is also claimed not to cake up in the container should the latter become heated.

VICTOR EQUIPMENT CO., 844 Folsom St., San Francisco 7.

* * *

Low Hydrogen Electrodes

RECENTLY made available, a new line of P&H low-hydrogen electrodes have many uses in almost every type of rolled and cast steel. For welding "problem" steels, high-carbon, cold-rolled, alloy, etc., there is a P&H 70LA (E-6015, E-7015). For the repair of steel castings, to match heat treating properties and analysis, the 70LB (E-7015) electrode is recommended. Nickel alloy and chrome-moly steels used in power piping are suited to the 75LP and 80LE electrodes, (E-8015). For steels of higher chrome content, steel castings matching the heat-treating properties of SAE 1040 and to weld high hardenable steels, there are several E-9015 electrodes available such as the 90LE, P&H.40C and AW2B.

To weld repair Grade C castings and steels of similar composition, an E-9016 electrode (P&H No. 7) is claimed efficient. To achieve good heat treating and flame-hardening characteristics comparable to SAE 8630 steel, two electrodes of the E-10016 class are recommended. For welding aircraft and similar steels and for welding high hardenable steels without preheat, two E-12016 electrodes are available.

HARNISCHFEGER CORP., 4513 West National Ave., Milwaukee 14.

(*Continued on page 78*)

The REID-AVERY CO. Inc.

DUNDALK · BALTIMORE 22 · MARYLAND

SINCE 1919 Producers of Arc Welding Electrodes and Welding Rods

The Largest and Most Modern Plant in the U. S. A. devoted exclusively to Wire Drawing and the Manufacture of All Types of Welding Rods and Arc Welding Electrodes. **ALL OF OUR PRODUCTS ARE MARKETED THROUGH AGENTS AND DISTRIBUTORS, WHO IN MANY CASES USE THEIR OWN TRADE MARKS AND DESIGNATIONS.**

Wire in catchweight coils of all standard welding grades. Furnished in Plain mill finish, Sull finish, and copper coated.

Straightened and cut lengths 14"-18"-36" standard.

Furnished in special rewound coils of all standard weights and dimensions.

Special layer wound coils for submerged arc welding.

Type D and Type M for automatic open arc welding in catchweight and special rewound coils. Type D is furnished in straightened and cut lengths for extremely high speed manual welding.

Raco composite Type A in special rewound coils. A fully shielded open arc automatic electrode. Furnished in mild steel, hard surfacing (3 grades), high tensile low alloy, and stainless steel grades.

We manufacture a full line of shielded arc electrodes of the highest quality offered to industry. Carbon steel grades, hard surfacing (3 grades), high tensile low alloy grades, ferritic, and many grades for special purposes.

We draw all of our own stainless steel wire, and manufacture a full line of stainless steel shielded arc electrodes. We furnish stainless steel welding rods in straightened and cut lengths for gas welding, also many grades of stainless steel welding wire in special rewound coils for submerged arc welding.

We manufacture Racolloy Nickel electrodes AC-DC for machinable welds on cast iron.

Raco Type M-9 Knurled wire for high quality, high production, automatic open arc welding.

Members of THE AMERICAN WELDING SOCIETY
THE NATIONAL WELDING SUPPLY ASSOCIATION

• With a thumb movement of barely over one quarter of an inch you light the full, adjusted flame on the Harris Automatic Torch. With a reverse motion you shut it off, leaving a small acetylene pilot light for subsequent relighting of the full flame.

When the Harris Automatic Torch is used, one hand is always free for holding filler rod, positioning work, changing pieces. The effect on output . . . both as to quantity and quality . . . is immediate and stimulating.

Beyond this is the very substantial economy of gases . . . both Oxygen and Acetylene . . . that is effected. After all, this is the basic advantage of the Harris Automatic Torch, repaying the investment cost time and time again.

Harris exclusive Distributors, located in principal Cities, will be glad to show this time and money saving Automatic Torch applied to your work . . and without the east obligation.

THE HARRIS CALORIFIC COMPANY
Cleveland, Ohio

HARRIS

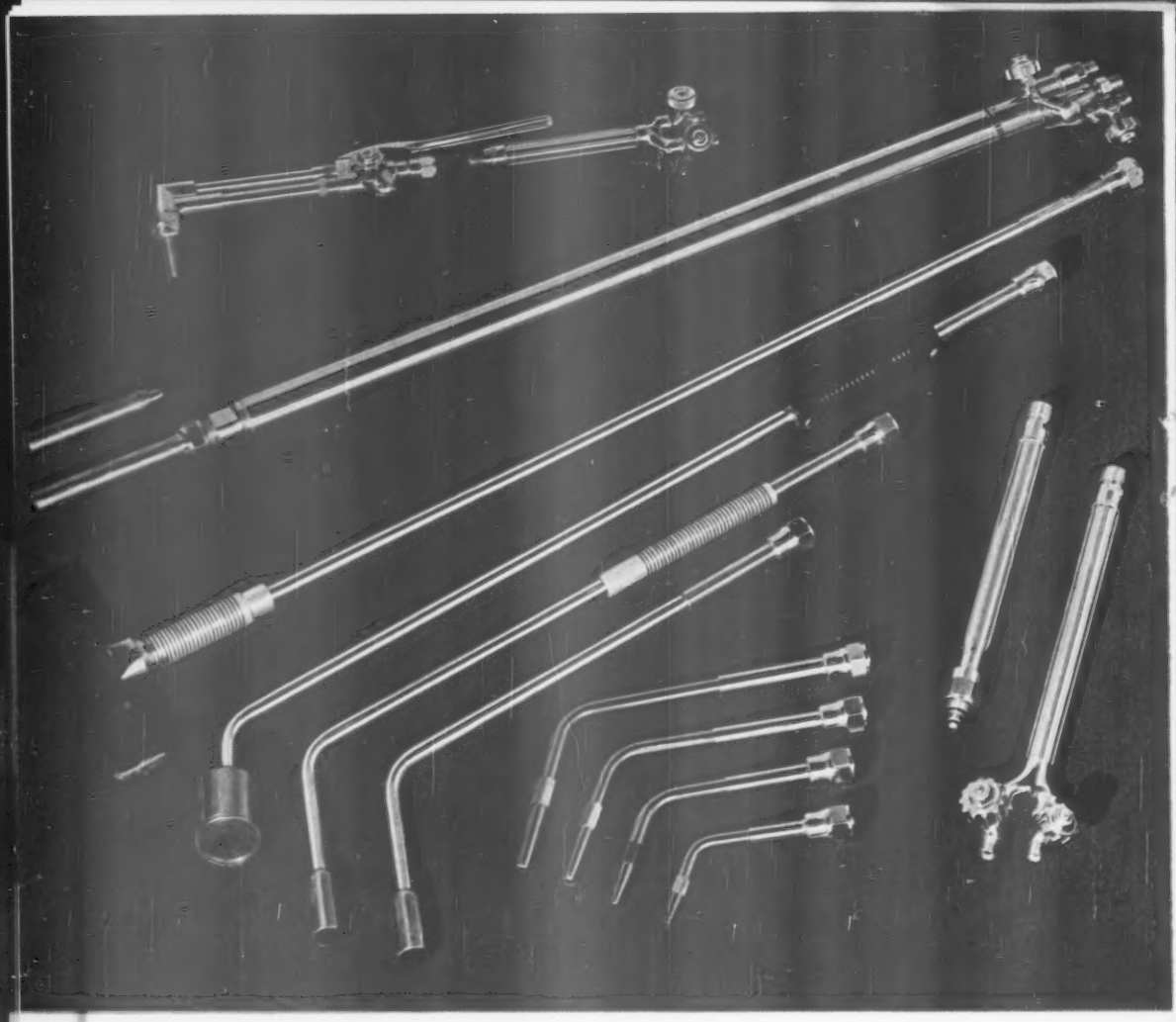
SERVING THE METAL INDUSTRY SINCE 1905

CONVERSION OF FRACTIONS TO DECIMALS OF AN INCH

Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
1/64	0.015625	21/64	0.328125	41/64	0.640625
1/32	0.03125	11/32	0.34375	21/32	0.65625
3/64	0.046875	23/64	0.359375	43/64	0.671875
1/16	0.0625	3/8	0.375	11/16	0.6875
5/64	0.078125	25/64	0.390625	45/64	0.703125
3/32	0.09375	13/32	0.40625	23/32	0.71875
7/64	0.109375	27/64	0.421875	47/64	0.734375
1/8	0.125	7/16	0.4375	3/4	0.75
9/64	0.140625	29/64	0.453125	49/64	0.765625
5/32	0.15625	15/32	0.46875	25/32	0.78125
11/64	0.171875	31/64	0.484375	51/64	0.796875
3/16	0.1875	1/2	0.5	13/16	0.8125
13/64	0.203125	33/64	0.515625	53/64	0.828125
7/32	0.21875	17/32	0.53125	27/32	0.84375
15/64	0.234375	35/64	0.546875	55/64	0.859375
1/4	0.25	9/16	0.5625	7/8	0.875
17/64	0.265625	37/64	0.578125	57/64	0.890625
9/32	0.28125	19/32	0.59375	29/32	0.90625
19/64	0.296875	39/64	0.609375	59/64	0.921875
5/16	0.3125	5/8	0.625	15/16	0.9375
				61/64	0.953125
				31/32	0.96875
				63/64	0.984375
				1	1

CONVERSION OF MILLIMETERS TO DECIMALS OF INCHES

Mm	In.	Mm	In.	Mm	In.	Mm	In.
1	0.03937	26	1.02362	51	2.00787	76	2.99212
2	0.07874	27	1.06299	52	2.04724	77	3.03149
3	0.11811	28	1.10236	53	2.08661	78	3.07086
4	0.15748	29	1.14173	54	2.12598	79	3.11023
5	0.19685	30	1.18110	55	2.16535	80	3.14960
6	0.23622	31	1.22047	56	2.20472	81	3.18897
7	0.27559	32	1.25984	57	2.24409	82	3.22834
8	0.31496	33	1.29921	58	2.28346	83	3.26771
9	0.35433	34	1.33858	59	2.32283	84	3.30708
10	0.39370	35	1.37795	60	2.36220	85	3.34645
11	0.43307	36	1.41732	61	2.40157	86	3.38582
12	0.47244	37	1.45669	62	2.44094	87	3.42519
13	0.51181	38	1.49606	63	2.48031	88	3.46456
14	0.55118	39	1.53543	64	2.51968	89	3.50393
15	0.59055	40	1.57480	65	2.55905	90	3.54330
16	0.62992	41	1.61417	66	2.59842	91	3.58267
17	0.66929	42	1.65354	67	2.63779	92	3.62204
18	0.70866	43	1.69291	68	2.67716	93	3.66141
19	0.74803	44	1.73228	69	2.71653	94	3.70078
20	0.78740	45	1.77165	70	2.75590	95	3.74015
21	0.82677	46	1.81102	71	2.79527	96	3.77952
22	0.86614	47	1.85039	72	2.83464	97	3.81889
23	0.90551	48	1.88976	73	2.87401	98	3.85826
24	0.94488	49	1.92913	74	2.91338	99	3.89763
25	0.98425	50	1.96850	75	2.95275	100	3.93700



TOP TO BOTTOM: VICTOR 100 Series welding torch butt and C1450-100 cutting attachment. New 4000 Series machine cutting torch. New stainless steel Model 362 descaling attachment, multiflame preheating nozzles, Type 3 welding nozzles, and 320 torch extension for use with 300 Series welding torch butt (shown at lower right). Attachment or nozzle change quickly made without wrench.

STANDARDIZE ON VICTOR
FLEXIBLE, VERSATILE WELDING and CUTTING UNITS

VICTOR

Hard-surfacing rod. Regulators for all gases. Machine and hand torches for welding, preheating, cutting, flame hardening and descaling. Portable flame cutting machines. Blasting nozzles. Cylinder manifolds. Cylinder trucks. Emergency pack-type flame cutting outfits. Fluxes. Write today for free descriptive literature.

It's easy to custom-build your outfit from* VICTOR *standard torch butts, attachments, nozzles, and tips.

Among VICTOR'S standard units you will find the right combination for all your cutting and welding operations, scarfing, deseaming, rivet piercing, hard surfacing. Furthermore, it is economical and easy to expand your VICTOR outfit to fit new needs.

Your VICTOR distributor will gladly help you custom-build an outfit for your specific job requirements. See him NOW.

VICTOR EQUIPMENT COMPANY

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FREE LITERATURE

Catalogs • Booklets • Bulletins

A Welding Engineer Reader Service To Help Keep Your Library Up-to-Date

1 WELDING POSITIONERS — Harnischfeger Corp., Milwaukee 14. 6-page two color Bulletin P2-1 describes the P & H Model WP-2 welding positioner with manual, handwheel or motorized rotation. Features such as hydraulic power-tilt, hand indexing device, telescopic elevation, etc., are discussed and pictured. Special mountings and fixtures are also included and illustrated.

2 RESISTANCE WELDING ALLOYS—Welding Sales & Engineering Co., Detroit 13. 12-page two color catalog gives recommended uses of RWMA alloys and the company's corresponding "Tuffaloy" tips and holders, bar stock, forgings, dies, seam welder wheels, tube mill wheels and castings. Six pages of tables give dimensions, type of tip, RWMA code number and special information on various alloys.

3 WELDING GOGGLES—Sellstrom Mfg. Co., Chicago 22. 4-page bulletin describes the new "Coverall" goggle for light welding and grinding. Design considerations which permit wearing of goggle over prescription lenses are discussed. Several other models of goggles and helmets are shown on the back page.

4 WELDORS GARMENTS — Racine Glove Co., Inc., Rio, Wis. 12-page catalog includes large photos showing construction features of "Gardsman" leather work gloves, weldors' gloves, stapled gloves, hand pads, arm protectors, sleeves, aprons and mitts. Descriptions accompany each illustration.

5 ELECTRODE DIRECTORY — Eutectic Welding Alloys Corp., New York City 13. 8-page three color bulletin describes and gives applications for more than 50 low-temperature welding rods and electrodes. Many photos show how the rods are used. Such specifications as diameters, tensile strength and as-deposited hardnesses are listed.

6 HARD-FACING ELECTRODE—Alloy Rods Co., York, Pa. 4-page Bulletin No. 10849 announces new chromeboride electrodes for hard-facing applications. Construction of the electrode, its operation and its uses are described.

7 MAGNETIC GROUND — Magnetrode Corp., Kansas City 8, Mo. Single sheet bulletin pictures and describes Model 1200 magnetic ground specially designed for use with turning rolls. Capacity, connections needed and other features are listed.

8 TOGGLE CLAMPS — Danly Machine Specialties, Inc., Chicago 50. 4-page two-color bulletin shows the Danly "Kwik-Klamp" toggle clamp in use in welding, machining, press and plastics applications. A chart gives the various types of clamps with their bar design, working pressure and holding capacities.

HOW TO ORDER: Fill out one of the small card sections completely (name, address, your company, etc.) for each piece of literature you would like to have. Each card section must be completely filled out; do not use ditto marks. Each circle must contain the number that appears with the item on which you desire further information.

Write in circle number of item describing one catalog wanted → ○

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Name John Smith

Address 321 7 Lewis Ave.

Chicago, Illinois Title Engineer

THE WELDING ENGINEER

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9 REFLECTOSCOPE—Sperry Products, Inc., Danbury, Conn. 4-page two-color Bulletin 50-105 describes the improved Type UR "Reflectoscope" for testing welds, forgings, etc., for flaws and discontinuities. Principle of its ultrasonic operation, and the equipment used with it are explained in layman terms. All specifications are included with a listing of components and various searching units.

10 ARGON METAL ARC—The Linde Air Products Co., New York City 17. 4-page folder describes the new Linde argon metal arc welding of thick aluminum sections. Work range, process advantages, welding speeds, equipment requirements, power and accessory equipment and welding procedures are discussed.

11 SHAPE-CUTTING MACHINE—Air Reduction Sales Co., New York City 17. 12-page two-color booklet describes the new No. 3 Monograph shape-cutting machine. Details of its construction, the tubular rail guide, the carrying case and the unit's portability are clearly shown in many drawings and photos. Maintenance features and typical applications are also pictured and described.

12 WELDED MACHINERY—Lukenweld Division, Lukens Steel Co., Coatesville, Pa. 22-page booklet entitled "Lukenweld Machinery" shows and gives a general description of jacketed steel drier rolls in various combinations and applications, sealing machines, flaker machines, coating machines, rotary press machines, miscellaneous processing equipment, positioners, slab turners, and straightening presses. An air-view plan of the entire Lukens facilities is included.

13 700-AMP HOLDER—Martin Wells, Inc., Los Angeles 1. 4-page bulletin 849-6S describes operating characteristics of the Wells No. 6S heavy-duty electrode holder for continuous operation at 600-700 amp. A performance report showing specifications, operating features and pyrometer readings in a test are included.

14 RESISTANCE WELDING — Acro Welder Mfg. Co., Milwaukee 3. Single sheet bulletin X-102 lists Acro service facilities such as engineering, repair of welding controls, design and building of transformers, replacement parts, and rebuilding of welders. Bulletin X-106 shows a special welder for twin-welding cans.

15 SOLDERING CATALOG—P. Wall Mfg. Co., Grove City, Pa. 24-page three-color Catalog No. 85 gives clear illustrations and specifications for a complete line of soldering products. Gasoline and kerosene blow torches, electric soldering irons, solder, splicer's furnaces, paraffin supplies and compound kettles are included. Also described are Wall oilers, grease buckets, shop torches and steel gongs and shells.

16 WELDING CLOTHING — Safety Clothing and Equipment Co., Cleveland 3, O. Four small 6-page folders describe weldors' aprons, electrode carriers, sweat bands, asbestos gloves, leggings, knee pads and shin guards. Styles and sizes for each are listed as well as alternate materials.

17 HARD FACING GUIDE—Mir-O-Col Alloy Co., Los Angeles 11. 32-page pocket-width booklet on hard-facing procedures discusses upsetting, preheating, heat treating, judging of good hard-facing, abrasion testing, proper thicknesses, jigging, gas process, metal arc method, warpage of crusher jaws, etc. Illustrated by drawings.

18 ELECTRODE CATALOG — The Champion Rivet Co., Cleveland. 32-page two-color Catalog 49-A gives complete descriptions of the company's mild steel, low alloy high-tensile, hard-facing, tool and die, cast iron and copper alloy electrodes and welding rods. Procedures, applications, physical and chemical properties and coating types are included for each electrode.

19 WELDING SAFETY CATALOG—Willson Products, Inc., Reading, Pa. 64-page catalog of eye and respiratory safety equipment discusses federal specifications for heat-treated glass, plastics in the safety field, types of filter glass for various uses, types of respiratory hazards and gas mask selector tables. Charts show comparative features of various styles of goggles, masks, helmets, etc.

20 DOT-WELD PROCESS—Metallizing Co. of America, Chicago 7, 8-page bulletin describes the patented "Dot-Weld" process for reclaiming and repairing cracked castings and motor blocks. Various successful applications are discussed and the companies doing the work are listed. Complete list of equipment and prices for each part are also included.

21 HEAT-TREATING — Lepel High Frequency Laboratories, New York City 23. 8-page bulletin describes the new all-steel constructed Lepel high frequency heating and metal joining units. Localized hardening procedures on couplings, small parts, gears and tubing is shown. Metal joining of carbide tips, fuse plugs and drills is also described.

22 SUBMERGED-MELT WELDING—The Linde Air Products Co., New York City 17. 36-page booklet, "Unionmelt Apparatus Catalog," contains new information on submerged-melt apparatus and supplies. Sections added include those on the portable DS welding head, the shape welding carriage and the flexible welder. Tables of recommended materials and procedures are included.

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More and more fabricators—sold on the smooth performance of M & T's "SELECT 70"* group of arc welding electrodes and the M & T new, up-to-the-minute AC and DC arc welders—are specifying M & T accessories for all-around assurance of top-notch welding.

Accessories such as top quality holders, shields, connectors, cleaning tools and protective clothing boost speed, safety and savings on all arc welding, whatever the job.

All the essential accessories to the **perfect** weld are provided in the Metal & Thermit line of welding equipment . . . M & T branded—symbol of superior welding!

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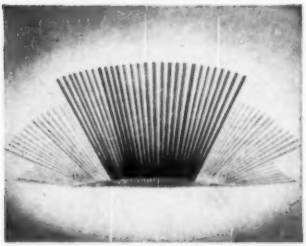
CHICAGO NEWARK CINCINNATI PHILADELPHIA CLEVELAND PITTSBURGH HOUSTON SO. SAN FRANCISCO MINNEAPOLIS TORONTO

FACTS AVAILABLE ON "SELECT 70"



DESCRIPTIVE literature covering mild steel, low alloy and special steel, stainless steel, hard surfacing and build up and other special electrodes is available to those requesting full information on M & T's "SELECT 70"—seventy electrodes designed to cover all arc welding requirements—AC or DC, all-position or downhand work welding of mild steel, low alloys and stainless steels as well as hard surfacing and building up of worn parts.

Literature is brief but comprehensive, covering specifications, properties and applications for each electrode. Copies available on request received on company letterhead. Address Metal and Thermit Corporation, 120 Broadway, New York 5, N. Y.

NEW ARC WELDERS BOOST AC and DC PERFORMANCE

FASTER welding, better quality welds, lower power costs, and simplified maintenance are furnished by a new line of AC and DC arc welders introduced by Metal and Thermit Corporation.

Built-in capacitors for high power factor, wide current range for full rated output—and fingertip, stepless current control for precise current setting are featured in the AC units. Available in 150 to 500 amp models for manual arc welding, additional models for inert arc and automatic welding.

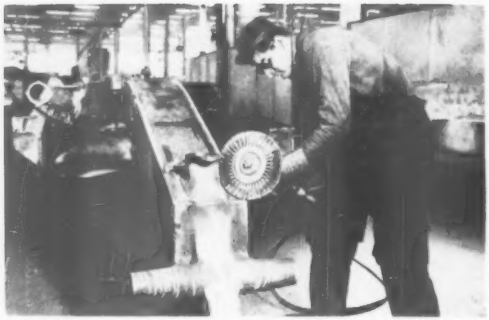
Full capacity, rugged duty DC arc welders are compact, light in weight—half the size and half the weight of older types—and are equipped with simplified current control, automatic electrode selector. Furnished in 150 to 400 amp sets—motor driven, engine driven or belt-drive.

Descriptive folder gives full particulars. Address Metal and Thermit Corporation, 120 Broadway, New York 5, N. Y.

on the job

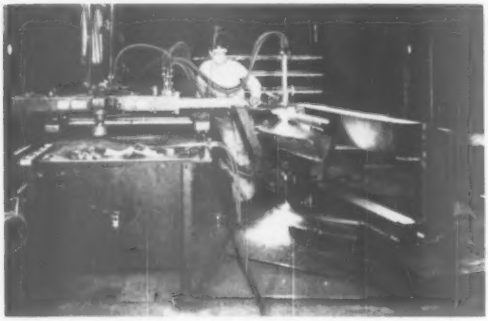
Courtesy American Brake Shoe Co.

FOUNDRY SAND gives severe abrasive wear to plow blades of a sand mulling machine. Hard-facing multiplies useful blade life by 32 times



Courtesy The Osborn Mfg. Co.

DISC-CENTER wire wheel brush made of 0.014-in. wire is effective in getting into joints and bends at Caterpillar Tractor Co., Peoria



Courtesy The Linde Air Products Co.

ROCKER ARMS for X-ray tables are flame-cut two at a time by upper and lower torches on a shape-cutting machine. Template guides cutting

McGraw-Hill Pacific Coast News Bureau

PARKLABREA, $40,000,000 Los Angeles housing project, has own welding shop to maintain hoists, trucks and construction equipment

Cutting X-Ray Table Rockers

X-RAY TABLES rest and roll on rocker arms to enable X rays to be taken in any required position. Fabrication of these arms presents a rather difficult production problem as the rockers must be cut in parallel planes to insure exact duplication of the contour. Furthermore, they must be cut out after being attached to the table framework.

Picture at bottom left shows how the problem was solved at the Baltimore plant of the Westinghouse Electric Corp. by using a flame-cutting machine equipped with torches above and below. Both rocker arms are cut out simultaneously from 1-in. mild-steel plate. The tracing head follows the template automatically, and the desired shape is duplicated in both workpieces.

* * *

Sand Muller Plow Hard-Faced

PLOW BLADES in a sand mulling machine are often called upon to mull more than 125 tons of foundry sand per day. Abrasive wear on the blades in the machine pictured at top left was so severe that plows had to be replaced on an average of every four days. And it takes two men 3½ to 5 hours to remove the old plows and replace them with new ones.

Useful life of the blades could be multiplied at least 32 times, it was found, by the application of tungsten-carbide hard-facing. The hard-facing rod selected was of the tubular type having finely granulated particles encased in a tube of mild steel. Particle size was 30 to 40 screen mesh; this item must be specified as rods of this type are supplied in a wide range of granulations from 5-8 to 40-125 screen mesh. When melted, the tube casing forms a steel matrix for the finely divided hard carbide particles, thus creating a surface having extreme resistance to wear.

Picture at top left was taken after four months of service. The original plows are still in place, and the foreman of the department estimated that they were good for at least two months more. He also estimated that during the six-month period the hard-facing application would save the company approximately $390 in castings and labor alone—to say nothing of reduced losses in production time.

Little Shop on Big Project

BENEATH the rising structures of the eighteen 13-story buildings of the Metropolitan Life Insurance Co.'s $40,000,000 Parklabrea housing project in Los Angeles is a unique welding-rigging shop (bottom right picture). Its 40-man crew, working under Ed Morse, general rigger foreman, is charged with maintaining truck fleets, construction equipment and also the hoists serving each building.

The welding shop is small since most members of the crew spend most of their time on the job. Nevertheless, it is efficient. The shop's two weldors built themselves a neat welding table from 1½-in. concrete-reinforcing rods. Six of these rods were cut into 5-ft lengths and spaced 3 in. apart to form the table top.

Portable welding outfits, both electric and gas, are taken to the site of the particular job concerned wherever possible. To get weldors to the repair scene in a minimum of time, telephone connections are maintained between the pouring floor and the rigging shop.

Parklabrea is going up at the rate of 18 floor pourings every 13 days.

Power-Brush Finishing

BY REMOVING weld slag and heat scale with power-driven rotary brushes, The Caterpillar Tractor Co., Peoria, Ill., secures clean, well-prepared surfaces for painting. Cost of preparation has also been reduced.

Top right picture of page 54 shows a large motor grader draw bar assembly and frame being wire brushed with a disc-type brush made of 0.014-in. wire. This type of brush is useful in getting into joints and bends; it is effective and easy to handle. A cup-type brush made of 0.035-in. wire is also used by Caterpillar for scale removal. Both types of brushes run on portable air tools.

* * *

Courtesy The Lincoln Electric Co.

CANTILEVER platforms are butt welded to a shaft of 24-in.-diameter, ½-in. steel tubing

Welded Diving Tower

HOUSTON'S fabulous Shamrock Hotel points with pride to its five and ten meter diving tower, unusually graceful appearance of which results in large measure from the extensive use of tubular materials. Unique design is the creation of Winfield A. McCracken, consulting engineer of Paddock Engineering Co. of Texas, Houston. Architect was Wyatt C. Hedrick, Inc., and the fabricator of the diving tower was A-1 Welding, both of Houston.

Shaft of tower is a 24-in. diameter tube of ½-in. wall thickness. It is 37 ft 8⅜ in. high and is topped with a stainless-steel ship's lantern, with a 1-in.-thick by 30-in.-diameter bolt ring at the base. Cantilever platform supports are 12-in., 20.7-lb channels, split and tapered to 6 in. at the outboard ends. These are butt welded to the shaft. Bridging struts are 6-in. junior beams. The top platform is 20 ft 8½ in. long and the bottom platform 17 ft 5 in. Floor beams consist of two 2 by 2½ in. angles at approximately 4-ft centers.

Stair treads are cast aluminum, stud bolted to the shaft and finished around their outside ends with an 18-gauge steel plate. Hand rails are of 1½, 1 and ¾ in. tubing.

For corrosion resistance and appearance, all of the steel parts are metallized with aluminum.

FOR MAXIMUM RESULTS AT THE LOWEST COST!

● In these days when cost has so much to do with the profit you can make, you will do best on welding, cutting or safety equipment by checking with Burdox first! Typical of the outstanding values and superior quality of the entire BURDOX line are six items shown below. Feature for feature, they give you savings at the start and in length of service as well. Get acquainted with BURDOX value by writing for free 64 page catalog today.

CYLINDER TRUCKS

DELUXE MODEL

The greatest cylinder truck value you've ever seen! Streamlined one-piece safety handle. Streamlined tool tray and rack. Bicycle type wheels with solid rubber tires. All welded construction. Chain holds cylinders securely.

JUNIOR MODEL

Ideal for handling small size cylinders! All welded tubular construction, mechanical rubber tires, oilless bronze bearings. Rolls like a charm. Adjustable telescoping tubular device holds cylinders securely.

EYEGARD GOGGLES

The best goggle value on the market! Super-light, impact-resisting plastic and exclusive 10-way ventilation. Cool and sweat-free . . . always!

BURDOX A-C ARC WELDERS

(150-200-250 amp. types)

- A whiz for work. Easy to operate. Weld up to 35% faster. Weld in any position. Shipped with accessories at a real saving!

EXTRA-FLEX CABLE

Extra-flexible, extra-resistance to abrasion, oil and water because of special construction. Millions of feet sold because of performance and price.

CYLINDER CONNECTIONS

- All brass, made to close tolerances, to do the job as only welding men know it should be done. Guaranteed against mechanical defects. Finest made, save time and money, yet cost no more.

THE BURDOX LINE INCLUDES:

WELDING AND CUTTING EQUIPMENT AND MACHINES • SOLDERING AND BRAZING OUTFITS • INDUSTRIAL GASES • REGULATORS AND GAUGES • HOSE AND CABLE • ACETYLENE GENERATORS • GOGGLES AND HELMETS • LENSES AND FACE SHIELDS • ROD AND FLUXES • CYLINDER TRUCKS

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REGOLATOR

The precision performance of the two-stage RegOlator is especially desirable for piped distribution systems and other applications where large volumes of high pressure gases must be controlled accurately.

Two-Stage RegOlator Gives You Plus Performance!

Constant delivery pressure regardless of drop in pressure at the inlet . . . Patented design incorporates nozzle-type first stage counterbalanced by stem-type second stage . . . Triple action cartridge filter eliminates troubles usually caused by rust, dust or dirt.

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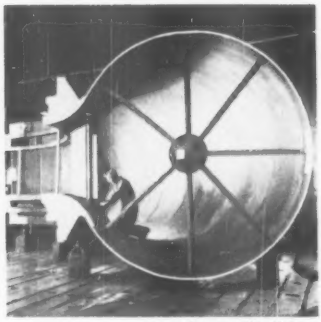


Courtesy Allis-Chalmers

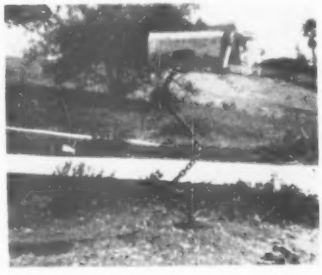
SPIRAL CASING section 4 for Bull Shoals hydro project is of all-welded construction

Welded Hydro Turbine

ALL-WELDED spiral casing section for the first unit of three 62,000-hp, 190-ft head, 128.6-rpm hydraulic turbines for the U. S. Department of Army, Corps of Engineers, Bull Shoals development is now being fabricated at the Allis-Chalmers shops.

Section pictured has a $3\frac{1}{4}$-in. plate thickness and weighs over 36,000 lb with its integral stay ring and temporary bracing. Combined casing and stay ring is designed in seven radial and circumferential sections. The stay ring portions bolt together, while the casing joints are designed for riveted butt-strap connections in the field. Total weight is about 228,000 lb, and diameter of the casing inlet is 14 ft 8 in.

* * *



NOT A VISE growing out of the ground but a metal chain is sole support of this mailbox. Chain is welded, one link to the next

Rigid Welded Chain

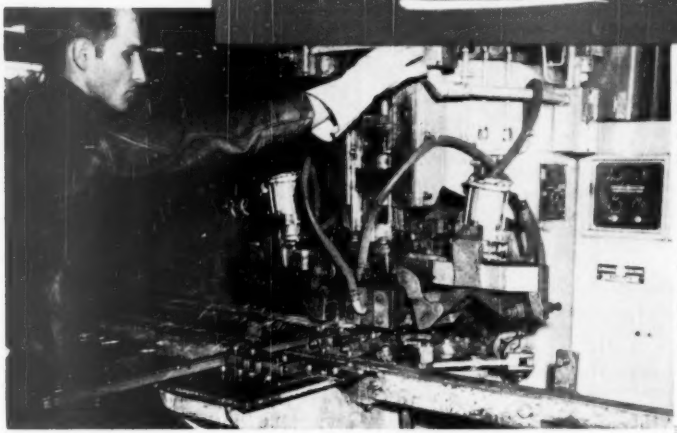
By Alan W. Farrant

AS an example of what a welder can do in his spare time, examine the accompanying picture. The decidedly unique "holder-upper" for a rural mailbox is a rigid chain made by welding each separate link to the one next to it. It takes time, sure, but think of the comments it will get from neighbors and visitors.

The same idea might be used to make a garden gate or to hold a bird bath, bird house, sun dial, etc. The chain can be draped in any design you like, and it will stay that way permanently.

NONSYNCHRONOUS CONTROL for resistance welding

Better than ever at lower Price!



G-E nonsynchronous control for resistance welders has been simplified, price reduced about 8 per cent.

EASY TO OPERATE—control station usually faces operator, but may be installed at the side of unit when mounted on machine, or may be separate.

EASY TO INSTALL—compact, factory assembled unit may be mounted on the side of the machine, floor, nearby wall, or balcony as space permits.

EASY TO SERVICE—entire side of cabinet is a hinged door which opens to provide quick, easy servicing of circuit components, power tubes, and water system.

All the control you need—including accessories—is contained in the modern attractive cabinet. Combines all the advantages of standard components with the specialized details and refinements required for your work. Nonsynchronous control is commonly required for welding standard steels such as are used for automobile bodies, stoves, furnaces, refrigerators, motors, etc. Here it is used for welding hinges to a steel window frame at Copco Steel and Engineering Company, Detroit, Michigan.

Only *two* relays as compared to the previous *six* cut sequence time, mean faster operation. There is less wear, therefore, *less maintenance required.* The entire unit is more compact—*takes less space. Timing is now controlled electronically.*

General Electric development engineering and improved manufacturing methods have again resulted in lower prices, better operating methods for the user of resistance welders. This is an example of the continued efforts at General Electric to give you more precise control of this process. When you have resistance welding control problems, contact the nearest G-E sales engineer. You'll be sure of unbiased answers. You'll get the *right* control for the job. And when you order control—specify General Electric.

SEE "This is Resistance Welding" . . .

General Electric's More Power to America four-color, sound motion picture covering every phase of this manufacturing process. Contains tips for improved production for operators of machines, design engineers, and supervisors. Contact your Resistance Welder manufacturer, Power Supplier, or the nearest G-E office.

Apparatus Dept.,
General Electric Co., Sec. E645-51C
Schenectady, New York

Please send me supplement No. 1 Bulletin GEA-4726 on Nonsynchronous Welding Control

I would like a showing of "This is Resistance Welding"

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GENERAL ELECTRIC

NEWS OF WELDING AND WELDING MEN

Boardman Elected Chairman Of Welding Research Council

DR. COMFORT A. ADAMS, who has served as chairman of the Welding Research Council since its beginning, was elected honorary chairman at the annual meeting in New York City, Nov. 3. H. C. Boardman, who has been serving as vice-chairman, was elected chairman, and Dr. A. B. Kinzel was elected vice-chairman.

Dr. Adams was the first president of the American Welding Society and the first director of the American Bureau of Welding, which position he held until the Bureau was discharged and the Welding Research Council organized under the Engineering Foundation, Inc., in 1935.

Mr. Boardman is research director of the Chicago Bridge and Iron Co., and an honorary member of the American Welding Society. Dr. Kinzel is president of the Union Carbide and Carbon Research Laboratories, Inc., and past chairman of the Engineering Foundation board.

* * *

Engineering Exposition Planned for Minneapolis

DEMONSTRATION of new equipment in all fields of engineering will keynote the fifth annual exposition of the Minnesota Federation of Engineering Societies, to be held in the Minneapolis Armory, Feb. 21-24. Men interested in tools, tool design and metal-fabricating processes are expected from as far west as Montana as well as from nearby North and South Dakota, Wisconsin and Iowa.

* * *

Here Are the Winners In Electrode-Guessing Contest

CHAMPION RIVET CO., Cleveland, staged a daily contest at the last Metal Show, object of which was to guess the number of electrodes in a transparent cylindrical container. Winners, their winning numbers and their companies are:

R. R. Schier, 1123, Fawick-Airflex Co., Cleveland; Lee Carter, 1148, The Lummus Co., Honesdale, Pa., and Bob Burger, 1148, Aluminum Co. of America, Cleveland; E. A. Koenig, 1164, The Yoder Co., Cleveland; Carl F. Joseph, 1109, Central Foundry Division, Saginaw, Mich., and W. A. Bidlingmaier, 1109, Truscon Steel Co., Cleveland; and I. S. Wishoski, 1186, *Industrial Heating*, Pittsburgh.

Prize for each day consisted of a set of stainless steel steak knives. On Oct. 18 and 20 two men tied for duplicate prizes.

* * *

Mid-States Welder Moves to New Plant

MID-STATES Welder Mfg. Co., Chicago, has moved its general offices from 2429 South Michigan Ave. and manufacturing operations from 6822 South Dorchester Ave. and 6823 South Kenwood Ave., to its new building at 6025 South Ashland Ave., Chicago 36.

* * *

Bridge Competition Dedicated To Professor Wilbur Wilson

THE 1950 "Welded Bridges of the Future" program sponsored by the James F. Lincoln Arc Welding Foundation is dedicated to Wilbur M. Wilson, research professor emeritus of structural engineering at the University of Illinois. The dedication was written by Professor Thomas C. Shedd of the Department of Structural Engineering at Illinois. Professor Wilson delivered the Adams lecture at the 1949 AWS convention.

Additions to the Rules Committee are also announced by the Lincoln Foundation. The new members are: Professor Frank W. Stubbs, Jr., Purdue University; Raymond Archibald, chairman AASHO Bridge Committee; Shortridge Hardesty, consulting engineer and a leading bridge designer.

Copies of the rules and conditions for the 1950 contest may be obtained by writing to James F. Lincoln Foundation, Cleveland 1. The contest closes June 30, 1950.

* * *

Sight Feed Names West Coast Distributors

THE Sight Feed Generator Co., West Alexandria, O., has appointed Western Oxygen, Inc., Seattle, Washington, and Industrial Air Products, Portland, Ore., as distributors for its full line of acetylene generators, overlay electrodes and hard-facing alloys.

* * *

New Detroit Address For Acetogen Gas Co.

ACETOGEN Gas Co., manufacturer of cutting gases, has recently moved to 20137 Sherwood Ave. (between Outer Drive and Eight Mile Road), Detroit.

* * *

New Steel Pipe Mill To Be Built at Orange, Tex.

CONSOLIDATED Western Steel Corp. will build a new 100,000-ton annual capacity plant for making 24-in. and larger welded steel piping at Orange, Tex. The company is a subsidiary of U. S. Steel Corp. The new mill had originally been intended for Houston, but negotiations recently completed with the government about the Orange property made it possible to start building there.

The new Texas plant will be the only U. S. Steel plant producing large-diameter welded piping between the Rocky Mountains and Pittsburgh.

Welding Aids the Oil Industry . . .

Courtesy The Lincoln Electric Co.

HALF-TRACKS carrying engine-driven welders had tough going on this stretch of pipe line between Bassfield and Collins, Miss. Towing was sometimes necessary. Contractor was Wunderlich and Griffis, Tulsa

Courtesy General Electric Co.

DISTILLING COLUMN 94½ ft long is all-welded except for manhole covers. Base has ⅝-in. plates and is 6 ft in diameter. Four top sections are 2½ ft in diameter. Fabricator was Arco-Atlantic Corp.

Such Popularity Is Deserved

Thousands of

P&H Dial-lectric AC Welders *are Cutting Costs Daily**

. . . because exclusive P&H built-in remote control saves welding time and money

Additional Features That Keep Welding Costs to a Minimum

- Easy quick-start arc
- Elimination of arc blow
- No moving parts to cause trouble, delays, or maintenance expense.
- A full range of sizes up to 625 amps.
- Connectible to 220 or 440 volts
- Compact design that requires little or no floor space
- NEMA rated
- High electrical efficiency that reduces power costs

The P&H built-in remote control saves you real money—it turns your weldor's walking time into welding time, gives him full finger-tip arc control at the work, lets him produce sounder, better-looking welds.

Trim your welding costs in a hurry. Install a P&H Dial-lectric AC Arc Welder — see the money-saving difference. Your P&H representative or distributor can give you more facts. Write for literature.

*Only 1½ years after their introduction to the field.

P&H ARC WELDERS
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Extra DIVIDENDS FOR USERS OF EASY-FLO AND SIL-FOS

RESEARCH — constantly seeking new and better ways of using the alloys and solving users' special brazing problems.

DEMONSTRATIONS — in your own shop to show what the alloys can do and how to use them correctly.

SAMPLE BRAZING — of specific parts sent in by customers to determine best brazing procedure.

"HOW TO" BULLETINS explaining in simple language the right way to apply low-temperature silver alloy brazing for various purposes.

ENGINEERING AID — to assure most effective application of low-temperature silver alloy brazing and correct joint design.

EMPLOYEE TRAINING
Users' employees may attend our brazing schools or we will help set up a training program in users' plants.

TECHNICAL BULLETINS
making available to users the facts and data on silver alloy brazing obtained through research.

The above services are all steps designed to help present and prospective users of EASY-FLO and SIL-FOS get the most out of the great time, labor and cost-saving benefits these low-temperature silver brazing alloys offer. They're yours for the asking.

For EASY-FLO and SIL-FOS details write for Bulletins 12-A and 15.

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A. O. Smith Changes Welding Sales Set-Up

SALES activities for welding electrodes and equipment of A. O. Smith Corp., have been transferred from the north central district, Chicago, to the welding electrode and equipment division, Milwaukee. All sales activities for welding products will be directed from Milwaukee under the supervision of J. T. Pritchard, division manager.

L. F. Vonier has been appointed general sales manager for the welding electrode and equipment division. Mr. Vonier has been with A. O. Smith for 14 years and brings much welding experience to his new appointment.

* * *

Bergstrom Electrodes Stocked on West Coast

COMPLETE stocks of Bergstrom hard-surfacing electrodes, made by Industrial Overlay Metals, Eaton, O., are now carried in the four U. S. Steel Supply Co. warehouses on the west coast.

U. S. Steel Supply now distributes the Bergstrom line from coast to coast from its warehouses at Boston, Newark, Baltimore, Pittsburgh, Cleveland, Chicago, St. Paul, Milwaukee, Moline, Ill., St. Louis, Los Angeles, San Francisco, Portland and Seattle.

The first stock of these electrodes was put into the St. Paul warehouse by U. S. Steel Supply in 1939 after they had been extensively tested on the heavy mining equipment on the Mesabi Iron Range in Minnesota.

* * *

All-Welded Construction Saves Submarine, Says Davis

THE WELDED construction of the hull and superstructure of the submarine *U.S.S. Tusk*, recently rammed in North Atlantic maneuvers, probably enabled it to withstand the collision and avert loss of life, according to A. F. Davis, vice-president of The Lincoln Electric Co.

The submarine was rammed by a 13,800 ton supply ship, the *Aldebaran*. All-welded, the *Tusk* was built in Cramps Shipyard in Philadelphia and commissioned in April, 1946. According to Mr. Davis, its arc-welded construction resulted in a strong, water tight hull able to withstand the severe stresses of the collision.

* * *

National Tube Completes Seamless Pipe Facilities

NATIONAL Tube Company's new facilities at Lorain, O., for the making of seamless pipe, have been almost completed. The installation includes new blooming bar and billet mills, new Bessemer steel plant, by-product coke ovens and a modern warehouse for pipe storage.

The continuous mill for seamless pipe is the first of its kind. It makes pipe ranging from 2-in. diameter to 4½-in. diameter at a capacity of 18,000 tons per month. The Bessemer converters are the first all-welded ones ever built and include a new deoxidation process to aid in seamless pipe production.

FOR GOOD SERVICE IN GOOD CONNECTIONS

Get acquainted with the well-stocked Tube-Turn distributor in your locality

TUBE-TURN

WELDING FITTINGS AND FLANGES

He handles the firmly established, quality brand of welding fittings and flanges. He handles a wide range of types and sizes. He carries a big stock. He knows piping. He is close at hand. For his address, write, wire, or phone your nearest Tube Turns' district office.

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Houston: 1704 Commerce Building, Charter 1668
Los Angeles: 447 General Petroleum Building, Madison 6-3219
New York: 150 Broadway, Rector 2-7844
Philadelphia: Broad Street Station Building, Rittenhouse 6-0722
Pittsburgh: 3001 Grant Building, Atlantic 1-8848
San Francisco: 2611 Russ Building, Garfield 1-2594
Tulsa: 317 South Detroit Avenue, Telephone 2-9193

TUBE-TURN SEAMLESS WELDING FITTINGS — RANGE OF SIZES

DESCRIPTION	STANDARD WEIGHT	EXTRA STRONG	SCHEDULE 160	DOUBLE EXTRA STRONG	LIGHT GAUGE NOMINAL PIPE SIZE	LIGHT GAUGE IRON PIPE SIZE
ELBOWS—90° Long Radius	½"-24"	½"-24"	1"-12"	¼"-8"	4"-24"	¼"-12"
ELBOWS—90° Short Radius	1"-30"	1½"-30"				
ELBOWS—45° Long Radius	½"-30"	¼"-30"	1"-12"	½"-8"	4"-24"	¼"-12"
RETURNS—180° Long Radius	½"-24"	½"-24"	1"-12"	2"-8"	4"-24"	¼"-12"
RETURNS—180° Short Radius	1"-30"	1½"-30"				
RETURNS—180° Extra Long Radius	1"-12"	1"-12"				
TEES—Straight	½"-24"	½"-24"	½"-12"	½"-8"		
TEES—Reducing Outlet	½"-24"	½"-24"	½"-12"	½"-8"		
REDUCERS—Concentric and Eccentric	½"x½" to 24"x20"	¼"x¼" to 24"x20"	½"x¼" to 12"x10"	¾"x½" to 8"x6"		
CAPS	½"-24"	½"-24"	1"-12"	1"-8"		
STUB ENDS—Lap Joint	½"-24"	½"-24"				
SADDLES	1"-24"**					
LATERALS—Straight	1"-24"	1"-24"				
LATERALS—Reducing on run	1"-24"	1"-24"				
CROSSES—Straight and Reducing	½"-24"	½"-24"				
RINGS—Welding Groove Type	½"-24"	1"-24"		1½"-8"		
RINGS—Welding Ridge Type	½"-12"	½"-12"				
SLEEVES—Welding	2"-24"**					

** Since saddles and sleeves are for external reinforcement only, they do not conform to iron pipe size thicknesses.

TUBE-TURN FORGED STEEL FLANGES — RANGE OF SIZES

DESCRIPTION	150 LB.	300 LB.	400 LB.	600 LB.	900 LB.	1500 LB.	2500 LB.
WELDING NECK	½"-24"	½"-24"	½"-24"	½"-24"	½"-24"	½"-24"	½"-12"
SLIP-ON	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-12"
LAP JOINT	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-12"
THREADED	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-12"	½"-12"
BLIND	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-12"
SOCKET TYPE	¼"-24"	¼"-4"	¼"-3½"†	¼"-3½"†			
REDUCING—Threaded or Slip-On	¼"-24"	¼"-24"	¼"-24"†	¼"-24"	¼"-24"*	¼"-12"	¼"-12"
ORIFICE—Threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
ORIFICE—Slip-On		1"-24"					
ORIFICE—Welding Neck		1"-24"	4"-12"	3"-12"	3"-12"	1"-12"	

† Dimensions on sizes thru 3½" same as for 600 lb. flanges.
* Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

In addition to carbon steel welding fittings and flanges listed here, the complete Tube-Turn line embraces many other metals and alloys—types 304, 347, and 316 stainless steel, carbon moly and chrome moly steels, copper, aluminum, brass, Monel Metal, Inconel, nickel, wrought iron. Ask your Tube-Turn distributor for catalogs and other reference material.

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Free Flowing

ELECTRODES

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2 OUTSTANDING Developments IN THE WELDING FIELD . .

For Electric Arc

1. DIMALOY COATED TUBE CARBIDE

Contains 96% Pure Tungsten Carbide—no filler—non-spilling—No Carbide in waste ends. *Coating all Metallic Alloy.*

2. DIMALOY COATED UNFILLED TUBES

Fillable with Crushed Carbide or you can make your own Alloy by inserting Manganese—High Carbon—etc. *Cuts Hard Rod Costs 30 to 50%.*

Available from your welding distributor—also from the *UNITED STATES STEEL SUPPLY COMPANY*—warehouses from coast to coast.

For complete facts write us direct or your nearest distributor.

Pat. Pending

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INDUSTRIAL OVERLAY METALS, INC.

EATON, OHIO

West Central NWSA Meets at Kansas City

SOME 20 manufacturers and 27 distributor members of the west central zone of the National Welding Supply Association met on Nov. 10 at the Muehlebach Hotel, Kansas City, Mo. This meeting was considered by those present to be one of the best zone meetings ever held.

The meeting was called to order by F. P. ("Dutch") Kohlbry, president, Machinery & Welder Corp., St. Louis, Mo., who is vice-president of the supply association. His remarks were followed by a talk by R. S. Mars on the importance of a strong national trade association. Mr. Mars is president of W. P. & R. S. Mars Co., a Duluth, Minn., distributor, and also president of the NWSA.

An interesting series of six papers discussed problems common to welding distributors and manufacturers of welding equipment. Authors of the papers and their subjects were:

R. C. Fernley, secretary of NWSA: A current review of association activities.

W. O. Schneiderwind, president, Omaha Welding Co., Omaha: How the manufacturer can assist the distributor in his sales effort.

M. L. Lampton, Lampton Welding Supply Co., Wichita: What we are doing to keep our accounts receivable within reasonable limits.

K. M. Walker, Remington-Rand, Inc., Kansas City, Mo.: A simplified inventory control system.

Ralph E. Chase, president, Chase Welding Supply Co., Inc., Benton, Ill.: How to conduct a welding clinic.

R. T. Rogers, president, R & R Welding Supply Co., Des Moines, Ia.: Can distributors be expected to carry and aggressively sell lines which do not provide an adequate gross margin?

Each paper was followed by a lively discussion period to develop better understanding of how to best tackle the various jobs which confront each and every distributor and manufacturer.

* * *

National Cylinder Gas Picks Portland Distributor

PORTLAND OXYGEN CO., a division of the National Cylinder Gas Co., has named the Oxygen Supply & Equipment Co., Portland, as an authorized dealer for NCG gases, welding equipment and supplies. The new dealer is located at 232 North Weidler St., Portland. The store has off-the-street parking and loading, extensive display rooms and a wide stock of welding items.

* * *

Pressure Rail Welding Gains in Popularity

THE pressure-welded railroad rail is here to stay. Lem Adams, vice-president of the Oxweld Railroad Service Co., speaking on this subject in a luncheon meeting at the Chicago Engineers' Club, Nov. 29, revealed that more than 500 miles of continuously welded rail are in use today throughout the United States and the greatest part of this trackage has had no maintenance costs.

Sales Training Discussed At New Orleans NWSA Meeting

EFFECTIVE methods of training salesmen to sell welding equipment were discussed by Charles O. Stillwell, president, Gulf Welding Equipment Co., New Orleans, at the southwestern zone meeting of the National Welding Supply Association on Dec. 7. Following Mr. Stillwell's paper, a lively discussion brought out various members' ideas about whether or not welding experience helped make better outside and over-the-counter salesmen.

Held at the St. Charles Hotel, the meeting was presided over by Howard R. Proctor, Welding Supply Co., Houston, Tex. Mr. Proctor is a vice-president of NWSA.

Several pieces of printed literature used to stimulate collections were exhibited by J. D. Morris, Jr., Teche Welding Supply Co., New Iberia, La., to supplement his paper on what can be done to keep accounts receivable to a reasonable limit.

Ideas on how the manufacturer can assist the distributor in his sales effort were presented by Gus P. Modlish, welding distributor from Jennings, La.

R. G. Harrison, sales manager of Welders Supply Co., Little Rock, Ark., led the discussion on the difficulty of selling without an adequate gross margin. While it was generally agreed that adequate margin was necessary to produce good sales effort, it was also pointed out that selling costs might be reduced.

R. C. Fernley, secretary-treasurer of NWSA, reviewed current association activities.

* * *

Four New Members Join NWSA at Atlanta

FOUR new members joined the National Welding Supply Association at its southwestern zone meeting on Dec. 6, bringing the total membership to 165. The meeting was held in Atlanta, Ga., at the Atlanta Biltmore Hotel.

After welcoming the 34 members and guests, R. P. McMillan, vice-president, Southern Oxygen Co., and vice-president of NWSA, called the meeting to order. The objectives of the association were outlined by Mr. McMillan for the benefit of new members and guests. Current activities of NWSA were then related by R. C. Fernley, secretary-treasurer of the association.

Lesley P. Beaver, Jr., Beaver Welding Supply Co., Memphis, Tenn., discussed some of the ways in which the manufacturer of welding equipment can assist the distributor in his sales effort.

A roundtable talk on the subject: "Can distributors be expected to carry and aggressively sell lines which do not provide an adequate gross margin?" was led by Thomas M. Taul, Jr., Mobile Welding Supply Co., Inc., Mobile, Alabama.

* * *

Oxygen Manufacturers Attend Chicago Meeting

THE Independent Oxygen Manufacturing Association held a two-day meeting at the Edgewater Beach Hotel, November 14 and 15. Members from all sections of the United States, Mexico and Hawaii attended.

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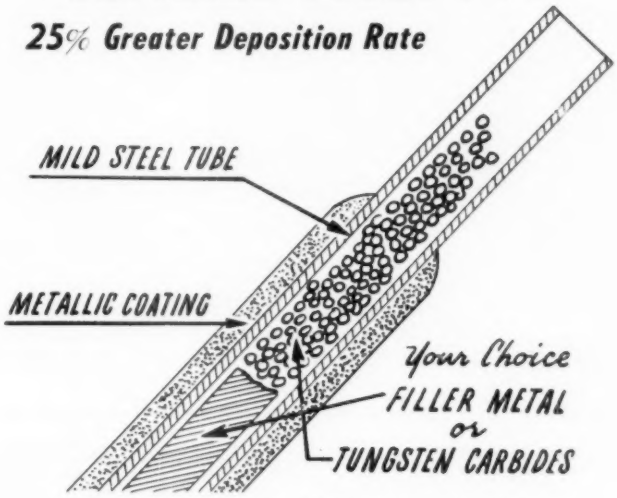
DIMALOY COATED UNFILLED TUBES . . .

25% Greater Deposition Rate



COMPARISON OF SAVINGS BY FILLING DIMALOY TUBES WITH YOUR OWN CARBIDE

One pound ¼" 10-20 Tube Carbide		$3.55
Equivalent cost of material to make one pound tube carbide using unfilled Dimaloy tubes		
4 Tubes (approx.)	@ .18	.72
5 Oz. carbide	@ .37½	1.87
		2.59
Savings per pound plus no carbide loss in waste ends.		.96

NOTE: Above costs figured on carbide $6.00 per lb. Dimaloy ¼" tubes $1.00 per lb. (6 approx.)

"SPILLING" of Carbides from the tube—a common fault of most electric carbide rods—is held to a minimum because of our treatment of the tube and enclosed treated packing material in BERGSTROM DIMALOY COATED UNFILLED TUBES. DIMALOY TUBES may be used on any arc welding machine—AC or DC. In some cases, by inserting a mild steel 1/16" or 3/32" rod and filling tube around this, the amount of carbide can be cut down and will give heavy build-up without sacrificing salability. A 1/8" acetylene tube carbide rod may be inserted in 1/4" DIMALOY TUBE without affecting its operation. DIMALOY TUBES may be used for making alloy deposits of your own choice—i. e., by inserting a rod of cast iron, an alloy may be deposited which will be very hard but not brittle like ordinary cast iron. Let us send you details. Write direct or to distributor near you.

• Available from your welding distributors—also from The UNITED STATES STEEL SUPPLY COMPANY—warehouses from coast to coast

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The MECO Safe-T-Chek is the only regulator with a *built-in*, self-actuating safety valve that controls excessive pressures due to careless handling or failure of seating. This *built-in* safety feature comes to you at no additional cost. See your MECO Dealer TODAY.

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A COMPLETE WELDING SHOP

6 Models in the 200 to 300 maximum ampere output range

Eliminate slow, laborious welding methods in your plant with outstanding Mid-States "Metal Zipper" arc welders. Their vastly superior design provides greater flexibility and provides absolute control on all metals—from light gauge to heavy castings and plate. The famous Mid-States "Missing Link" high frequency arc stabilizer eliminates "pecking" or "scratching" to start the arc because the arc starts automatically before the rod touches the metal.

Positive, pre-selected heat control means perfect control on light gauge work, less chance for burning, and dense, strong welds with a minimum of waste metal. With "Metal Zippers," experienced operators work faster, do better work, save money, reduce fatigue.

Let Mid-States "Metal Zippers" improve quality and increase production in your plant now. The prices are amazingly low and "Metal Zippers" have gained a real reputation for "paying off" in a matter of days.

Write for further information *today* on the heavy-duty line of "Metal Zippers"—the welders unequalled for factory maintenance and production.

Contact Your Jobber or Write for Details and Specifications

MID-STATES WELDER MFG. CO.

6025 SOUTH ASHLAND AVENUE CHICAGO 36, ILLINOIS

Indiana AWS Section Wins Quiz Contest

A "Quiz the Expert" program spotlighted one of the most successful meetings of the year for the Chicago section of the American Welding Society, held on Nov. 18 in the auditorium of the People's Gas Light and Coke Co. Four-man teams from the Milwaukee, Indiana and Peoria AWS sections participated for the honor of going to Detroit for the international competition in 1950. The Chicago section did not participate as it has won the past several contests.

Questions for the quiz covered arc, gas and resistance welding, metallurgy and welding research. Each team was allowed to answer first on at least one question in each of the five groups. If, in the opinion of the four judges, the question was not properly answered, the other two teams were given a chance to score points by completely answering the question.

After a neck-and-neck race right down to the finish, Indiana section won first price, a special "atom splitter" machine of all-welded construction. Indiana won with a score of 133 points over Milwaukee's 123. Peoria was third with a score of 73.

The Indiana section was represented by Ray Wirt as captain, Carl Sauer, E. Gochringer and Ed Holt. Paul Grubbs was the alternate team member. The four-man team from Milwaukee was headed by E. C. Brekelbaum as captain, J. J. Chyle, G. Welsh and M. Scheil.

The Peoria section team was captained by Kenny Jackson. Team members were Harold Baldwin, Jim Powell, Don McCowan, Larry O'Day (alternate) and Mort Packer (alternate). Mr. O'Day is a member of the executive committee of the section and Mr. Packer is secretary.

Judges from the Chicago section were Dr. John Parks, R. P. Monroe, L. S. McPhee and C. L. Pfeiffer. Moderator was R. E. McFarland.

* * *

1,400 Training Films Listed in New Directory

A NEW "Industrial Film Bibliography" listing 1,400 motion picture and slide training films has been distributed to 2,000 members of the National Metal Trades Association. The "Bibliography" offers information on audio-visual aids for supervisory and employee training programs, descriptions of films, contents, running time, availability, sound or silent type, black-and-white or color. Non-members may secure a copy by sending $2 to the NMTA, 122 South Michigan, Chicago.

* * *

New Telegraph System Speeds Orders for Steel

A NEW private telegraph switching center was recently installed at Carnegie-Illinois Steel Corporation's offices at 208 South LaSalle St., Chicago. The new center is a part of a 21,000-mile leased network connecting plants and offices of U. S. Steel Corporation. The new push button-type center in Chicago switches 12,000 incoming messages daily to destinations all over the nation.

ALCOA ELECTRODES AND WIRE FOR FAST, ECONOMICAL ALUMINUM WELDING

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Near as your phone!

A local or L. D. phone call will put you in touch with a good man to know . . . your Alcoa distributor. He carries the world's most complete stock of the world's best welding supplies. Flux—solder—brazing sheet and wire—electrodes—wire. All made by the men who know aluminum best. All consistent in quality and dependable in performance. If there is no Alcoa distributor near you, write ALUMINUM COMPANY OF AMERICA, 1943A Gulf Building, Pittsburgh 19, Penna.

ALCOA DISTRIBUTORS NATIONWIDE:

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- J. M. Tull Metal & Supply Co., Inc.

Baltimore, Maryland
- Whitehead Metal Products Co., Inc.

Boston (Cambridge), Massachusetts
- Whitehead Metal Products Co., Inc.

Buffalo, New York
- Brace-Mueller-Huntley, Inc.
- Whitehead Metal Products Co., Inc.

Charlotte, North Carolina
- Edgcomb Steel Company

Chicago, Illinois
- Central Steel & Wire Company
- Steel Sales Corporation

Cincinnati, Ohio
- Williams & Company, Inc.

Cleveland, Ohio
- Williams & Company, Inc.

Columbus, Ohio
- Williams & Company, Inc.

Dallas, Texas
- Metal Goods Corporation

Detroit, Michigan
- Steel Sales Corporation

Houston, Texas
- Metal Goods Corporation

Kansas City, North, Missouri
- Metal Goods Corporation

Los Angeles, California
- Ducommun Metals and Supply Co.
- Pacific Metals Company, Ltd.

Newark, New Jersey
- Whitehead Metal Products Co., Inc.

New Orleans, Louisiana
- Metal Goods Corporation

New York, New York
- Whitehead Metal Products Co., Inc.

Philadelphia, Pennsylvania
- Edgcomb Steel Company
- Whitehead Metal Products Co., Inc.

Pittsburgh, Pennsylvania
- Williams & Company, Inc.

Portland, Oregon
- Pacific Metal Company

Rochester, New York
- Brace-Mueller-Huntley, Inc.

San Francisco, California
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FLUX • SOLDER
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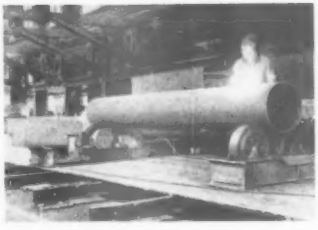
Less Handling—More Welding

It's handling that costs most in welding . . . the crane work or manual labor in positioning the pieces—plus the welder's *waiting* time.

Get more arc-time from every hour by using Worthington-Ransome Turning Rolls to handle tanks, drums or any type of cylindrical vessel regardless of size. They continually bring the work into position for efficient, economical *downhand* welding (manual or automatic) with heavier electrodes which means fewer passes and better welds.



50% greater production on both repetitive and job work has been reported by users.

Capacities from 3 to 75 tons, up to 14 ft. diam., stationary or self-propelled. (Rolls for heavier or larger work also available.)

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Welding and Assembly Positioning Equipment Division

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Worthington Pump and Machinery Corp.
Dunellen, N. J.

Please send Bulletin 228 on Worthington-Ransome Turning Rolls.

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Radioactive Cobalt Will Make Gamma-Ray Inspections

A 350 millicurie source of Cobalt 60, a radioactive isotope, has been received at the St. John X-Ray Laboratory, Califon, N. J., to be used in place of radium in industrial radiography. The new material has a smaller focal spot size than the equivalent amount of radium so better results are anticipated in tests. A separate building has been designated for the exclusive use of the new material.

* * *

Metallurgists Are Best Paid of All Engineers

METALLURGY is the highest paid of the engineering professions, according to a recent nation-wide survey conducted by the American Society for Metals. Average annual income for a metallurgist was found to be $6,567. The national average income for all types of engineering, according to the U. S. Bureau of Labor Statistics, is $4,668. The average yearly income of all college graduates in the U.S. is $4,689, while the average yearly pay of all U.S. workers is $2,840.

* * *

Courtesy The Lincoln Electric Co.

WELDED STADIUM seats add 21,000 capacity to University of Michigan football arena

Welded Steel Sections Adds 21,000 Stadium Seats

TO HANDLE increasingly larger football crowds at the University of Michigan stadium, an all-welded steel seating section was put on top of the present concrete structure at Ann Arbor, Mich. This increases the original seating capacity from 76,000 to 97,000.

Steel plates ¼-in. thick were formed into a single step section and then shop-welded into four-step units. These units were in turn welded together in the stadium. Each 15-ft. section was welded continuously to the section immediately below it and to the section adjacent. Seat supports were welded to the step sections, and wooden seat boards were then fastened to these supports.

All horizontal fillet welds and the flat butt welds between step sections were made with E-6020 electrodes. Vertical welds on the step risers were made with E-6010 electrodes.

Steel was furnished, erected and welded by Whitehead and Kales of Detroit. General contractor was Henry De Koning Construction Co., Ann Arbor.

Valley Oxygen Company Moves to New Building

VALLEY OXYGEN CO., Bay City, Mich., is now doing business in a new 60 by 100 ft. building at 311 Columbus Ave., Bay City. The new building occupies a corner site with 100 ft frontage in one direction and 276 ft in the other. It contains show room, office and warehouse space.

The firm was started in 1936 as the Morris Jaffe Co. to handle only oxygen and acetylene. In 1940, Mr. Jaffe formed an independent concern, the Valley Oxygen Co., which has outgrown several business locations. Robert Jaffe, Mr. Jaffe's son, was appointed manager of Valley Oxygen in 1947.

Valley Oxygen was the first welding dealer in the area to supply gas and equipment by truck to his rural customers on a weekly "milk route" basis. The trucks also carry a selection of electrodes, welding rods and small accessories.

Among other than welding gases supplied to customers, the company also stocks helium, chlorine, nitrogen, compressed air, carbon dioxide, propane, nitrous oxide and cyclopropane. Recently a medical gas service and oxygen-tent rental has been established.

A repair department is maintained for oxyacetylene welding and cutting equipment as is a free technical engineering service for customers.

* * *

Welded Trusses Used In A. O. Smith Houston Plant

CONTRACTS have been awarded to the Austin Co. for design and construction of the large-diameter welded steel pipe mill at Houston, Tex., to be erected for A. O. Smith Corp. of Texas.

The plant will require 1,300 tons of structural steel over its 150,000 sq ft area. Trusses of Austin standard H-section welded design will be used. A clearance of 33 ft will be maintained below the trusses. The plant will have two 80-ft craneway aisles, each equipped with two 20-ton cranes and an intermediate 40-ft aisle, all extending the 675-ft length. A 40 by 200 ft steel frame and masonry air-conditioned office building is also included in the contract.

The new plant will produce about 35,000 tons of pipe per month, ranging in size from 8⅝ in. to 30 in. and larger.

* * *

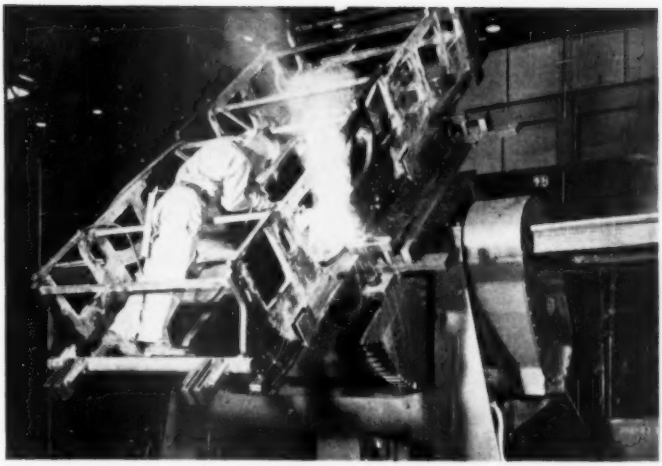
Black Mfg. Moves Service Department

SERVICE department of The Black Mfg. Co., formerly located at 1424 West Baltimore St., Baltimore, Md., has been moved to Dairy Road, Parkton, Md. The company manufactures oxyacetylene welding torches.

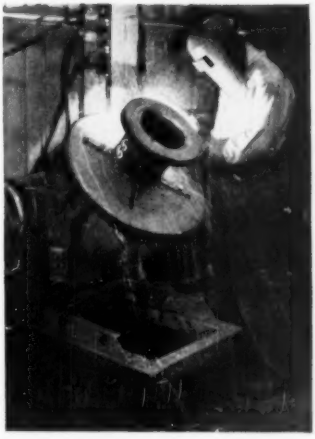
* * *

Long Beach Distributor Moves to New Store

LONG BEACH Welders Supply has moved to a new store at 1629 East Anaheim Blvd., Long Beach, Calif. It has recently become distributor in the Long Beach area for Victor gas welding and cutting apparatus and the General Electric arc-welding lines.



More Arc-Time Per Hour



You pay your welders for welding . . . so the time it takes them to *position* the work—or themselves—is *lost* welding time.

But a Worthington-Ransome Positioner quickly tilts and rotates the work for practically *continuous* welding—always in the efficient *downhand* position that permits using heavier electrodes for *quicker, neater, better* welds.

Mass production or job welding . . . small pieces or "crane" work . . . automatic or manual welding—Worthington-Ransome Positioners quickly *pay* for themselves with increased production, lowered labor costs—up to 50%.

Capacities from 100 lb. to 20 tons.

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Welding and Assembly Positioning Equipment Division

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50% PRODUCTION UP LABOR COSTS DOWN

Welding Positioners Turning Rolls

Worthington Pump and Machinery Corp.
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It contains 1398 charts, illustrations and figures—274 tables—16 valuable data sheets—90 pages of trade names—all in over 1000 pages. The twelfth edition is now ready. **$6.50 per copy**

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By T. B. JEFFERSON

• For those who are desirous of adding to their storehouse of knowledge on oxy-acetylene welding, this book is just the thing. It describes this particular type of welding explicitly—and to date it has proven quite valuable to those using it.

Revised, enlarged and brought up to date, this 4th Edition is the most complete volume released giving weldors 264 pages of data specifically on oxy-acetylene welding. **$2.50 per copy**

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By using the handy index, the answer to any question regarding welding—for both the novice and expert alike—can be found on one of the 176 profusely illustrated pages. **$1.50 per copy**

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• Seven chapters containing complete data for those actively engaged in welding design. A large section specifically devoted to a consideration of the basic design problems. In addition, single pages of data are included, grouped to give pertinent information on welding processes, weld joints and stresses, welded design, cost, materials, pipe data and engineering tables. **$1.50 per copy**

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- ☐ WELDING—ITS QUESTIONS and ANSWERS $1.50 per copy
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Eye injuries amount to about one-third of industrial accidents. Yet with proper precautions 90% of these can be prevented. All too many seem to be gambling on their good luck—and with disastrous results. Far better to follow the recommendations of safety experts and choose the right protection for each job.

For Gas Welding, Cutting, and Brazing, Jackson Headrest Goggles type W-50 are light and easy to wear, with or without prescription glasses, are simple and easy to adjust, easy to raise and lower.

Goggle assembly is hinged from headrest with telescopic arms, held gently against the face by concealed springs. Spring clips hold arms to headrest to provide added adjustment and easy replacement. Headrest of light, easy to clean plastic, adjustable for size.

Plastic eye cups easily fitted to the face. Outside of each cup has ventilating screen to prevent fogging and baffle plate to keep flying particles and light rays out. 50 mm. glass lenses are available in standard shades from 3 through 6, and have cover glasses to protect them.

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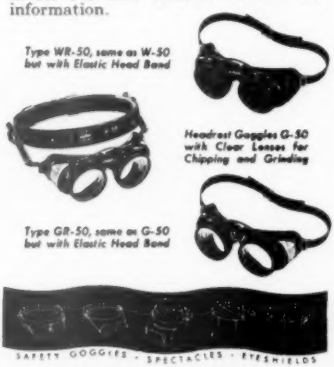
Type WR-50, same as W-50 but with Elastic Head Band
Headrest Goggles G-50 with Clear Lenses for Chipping and Grinding
Type GR-50, same as G-50 but with Elastic Head Band

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Test Welded Plates For Pressure Vessels

R. D. Stout, associate professor of metallurgy, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa., presented a paper entitled, "Effect of Welding on Pressure Vessel Steels" at the 70th annual meeting of the American Society of Mechanical Engineers held in New York City, Nov. 27-Dec. 2. Co-authors were A. F. Scotchbrock, research assistant; L. Eriv, research assistant and B. G. Johnston, director, all of the Fritz Engineering Laboratory.

The evening session at which the above paper was given was held under the joint auspices of The Research Committee on Strength of Vessels Under External Pressure and the Pressure Vessel Research Committee of the Welding Research Council.

The object of the tests discussed in Dr. Stout's paper was to determine the effects of prestraining, welding and postheating on the notch toughness of six steels of pressure vessel grades of ⅝ and 1¼ in. thickness. Little difference in effect was noted because of high and low welding heats. The welding of prestrained material noticeably lowered the notch toughness for every steel.

A postheat of 500 F did little to restore the former qualities of the steel, but a 1,150 F postheat did help to bring back the notch toughness.

* * *

Compressed Gas Men Plan Seminar on Cylinders

SCHEDULED to appear before the Jan. 23-24 meeting of the Compressed Gas Association, Inc., in New York City, are Dr. C. C. Furnas, Director of Cornell Aeronautical Laboratory and H. W. Steinkraus, president, U. S. Chamber of Commerce, who is also president of the Bridgeport Brass Co. Dr. Furnas will speak at the luncheon meeting on Monday, Jan. 23. Mr. Steinkraus has been invited to speak at the Tuesday luncheon meeting.

Five specialists in cylinder construction, metallurgy and design will conduct a seminar on "Materials for Construction of Cylinders" the afternoon of Jan. 24. A member of the staff of E. I. duPoint deNemours & Co. will speak on titanium. A paper will also be presented on underwriters examinations for testing gas products.

* * *

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Single-Span Welded Pipe Crosses Australian River

A WELDED water main of 48-in. ID was recently laid in a single 70-ft span across the Sturt river in South Australia. Loaded, the weight of the pipe between supports was 37.7 tons.

The pipe was fabricated of 7/16-in. plate, submerged-melt welded into 30-ft lengths. Each length was concrete-lined to a thickness of 1⅛ in. by the spinning method. To cross the dry river bed, three 30-ft sections were welded together with a 3½-in. camber in the total span.

For obtaining better stress distribution at the support points, eight stiffening bands were welded onto the pipe shell, four on each side of the support ring. These were built up to a taper from layers of diminishing width and thickness. The band welded directly onto the pipe has a width of 7 in. Support rings were welded to legs anchored in the concrete foundation. Welding was done by the South Australian Engineering and Water Supply Department.

McGraw-Hill World News

* * *

New G-E Appointments

Seven appointments in General Electric Co.'s Apparatus Department have been announced by H. V. Erben, G-E vice-president and general manager of the department. They are: NEIL CURRIE, JR., from manager of manufacturing to administrative assistant to the general manager; ERNEST E. JOHNSON, from manager of engineering to manager of engineering, large apparatus divisions; CARL A. SALMONSEN, from manager, aircraft gas turbine divisions, to manager of manufacuring, large apparatus divisions; BYRON A. CASE, from assistant to manager of engineering, to manager of engineering, small apparatus divisions; FRANK T. LEWIS, from manager of manufacturing, aeronautic and ordnance systems divisions, to manager of manufacturing, small apparatus divisions; CLARENCE H. LINDER, from assistant manager of manufacturing to assistant to the general manager; C. W. LAPIERRE, from assistant manager, aircraft gas turbine divisions, to manager, aircraft gas turbine divisions.

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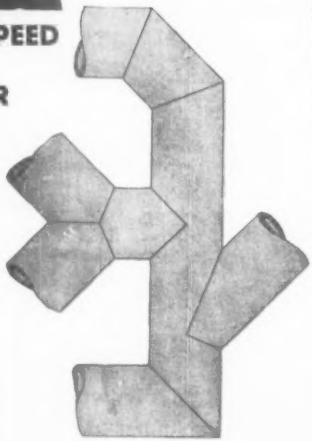

"But I don't wanna be President! I want to be a weldor like Pop!"

About People

WILLIAM C. BRUTON has been appointed district sales manager for American Manganese Steel Division of American Brake Shoe Co. ROBERT H. ELEM has been appointed Pacific Coast manager of the welding products department. Mr. Bruton will make his headquarters at the division's plant in Oakland, Calif. Mr. Elem, formerly a welding engineer for the company, is a member of the American Society for Metals and the American Welding Society. His headquarters will be at the division's Los Angeles plant.

* * *

WILLIAM MOBLEY, service engineer for the Iowa territory of Omaha Welding Co., Omaha, since 1928, has been promoted to welding engineer. He will be in charge of sales promotion of welding equipment and supplies. In addition, Mr. Mobley will assist customers in specialized welding problems and train the company's service engineers. Previous to his employment with Omaha Welding Co., he operated a welding and machine shop at Logan, Ia.

* * *

J. O. CLEVENGER has been appointed manager of Westinghouse Electric Corporation's welding department. Mr. Clevenger joined the company as a member of the graduate student course in 1927. In 1939, Mr. Clevenger became manager of the construction and communication section. He was transferred to Atlanta, Ga., as manager of agency and specialty sales for the southeastern district in Jan., 1947.

* * *

J. P. COUCHLIN has been named manager of field sales, welding department, Westinghouse Electric Corp., Buffalo, N. Y. He joined the company in 1939 and subsequently served as welding sales engineer for the southwestern district in St. Louis. During the war he served as a naval officer in charge of welded construction at several shipyards. In 1945 he returned to Westinghouse as manager of welding products,agency and specialty sales department, East Pittsburgh.

* * *

BERNARD W. WEBER has been appointed manager of Metal & Thermit Corp.'s detinning and electrode manufacturing plant at East Chicago, Ind. W. S. LEINHARDT, formerly general superintendent of the East Chicago plant is now at the company's executive offices in New York as technical assistant to the vice-president of production. WILLIAM C. CUNTZ, formerly manager of the company's sales office and warehouse in Pittsburgh, has been made district manager at Chicago. ORVILLE T. BARNETT, formerly manager of the Newark, N. J., office has been appointed district manager at Pittsburgh. ROBERT T. BROWN, formerly head of technical service on both electrodes and Thermit has been made district manager at Newark.

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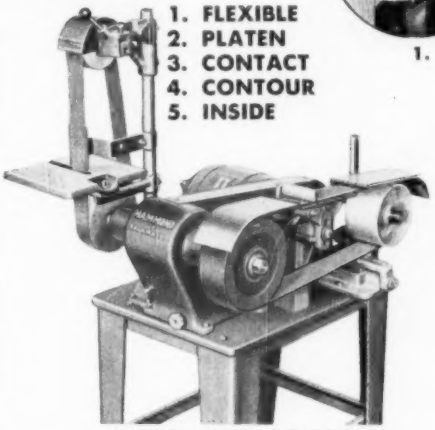

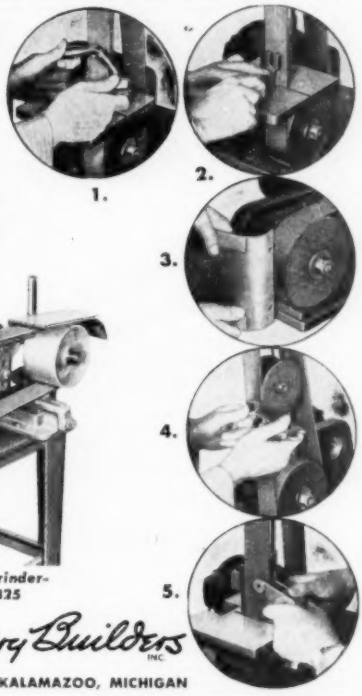

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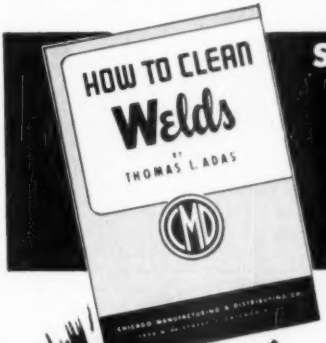

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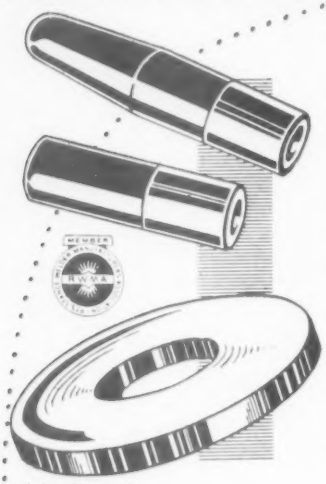

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R. J. McCallian has been appointed district sales manager for southeastern United States by the Stulz-Sickles Co., Newark, N. J. He will have various duties including the aiding of distributors and customers with difficult welding problems.

* * *

Al Bright has joined the sales force of the Big Three Welding Equipment Co., San Antonio, Texas. Mr. Bright will specialize in welding applications in the refineries and oil fields.

* * *

William K. Beard, Jr., formerly vice-president and manager of promotion of McGraw-Hill Publishing Co., New York City, has been elected to the post of executive vice-president of the Associated Business Publications. Mr. Beard was with McGraw-Hill for 26 years.

* * *

Dudley W. Figgis, former president of the American Can Co. and now chairman of its board, has been elected a vice-chairman of the Board of Trustees of Stevens Institute of Technology. He is a director of the Metal & Thermit Corp.

* * *

Morse G. Dial has been elected a director and Kenneth H. Hannan elected secretary of Union Carbide and Carbon Corp., New York City.

* * *

J. Lyell Wilson, research director, American Bureau of Shipping, has applied for retirement on Jan. 1, 1950.

* * *

H. C. Mathey has been elected president of Stuart Oxygen Co., manufacturers of industrial and medical gases. He succeeds W. A. Brown, Jr., who remains as a director of the company. Mr. Mathey will continue to serve as general manager of the Pacific Division of Liquid Carbonic Corp., of which Stuart is a wholly-owned subsidiary.

* * *

Charles E. Rogers has been named sales metallurgist for Stoody Co., hard-facing manufacturers of Whittier, Calif. He has had more than 14 years experience developing and producing hard-facing alloys.

* * *

Died . . .

Francis J. Hood, president of Ansul Chemical Co., Marinette, Wis., died Nov. 10 while on a business trip to New York City. He was 44. He was elected president less than a year and a half ago. A member of the Compressed Gas Association, he was a past president of Refrigeration Equipment Manufacturers Association.

* * *

Fred R. Klaus, 75, vice-president and general manager of United Manufacturing Co., Cleveland, died Nov. 24. His first venture into manufacturing was as co-founder and president of the Cleveland Welding Co. He had also been plant manager of the American Welding Mfg. Co., Warren, O., and later founded the United Wheel & Rim Co. in that city.

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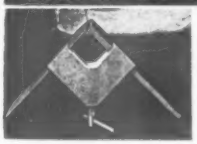

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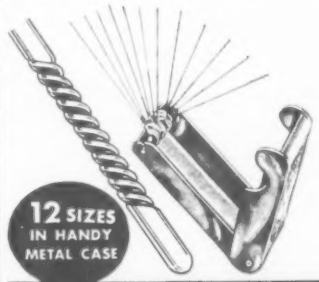

THERMACOTE CO.
Newark, N. J. Chicago, Ill. Los Angeles, Calif. Portland, Ore.

30 YEARS AGO

(From THE WELDING ENGINEER of January, 1920)

USES of welding in the 103rd Aero Squadron, the 3rd Pursuit Group and the 2nd Air Park during the war are described by W. H. Bleecker, Jr., district sales manager for Page Steel & Wire Co., Chicago. Uncertainty of oxygen and acetylene supply from French sources handicapped operations, but repairs to airplane engines, trucks, passenger cars and motorcycles were regularly accomplished. At times the welders used acetylene intended for motorcycle lights and oxygen in small bottles meant to be carried by fighter pilots.

—30 YEARS AGO—

CHARLES L. BASTIAN, president of The Bastian-Blessing Co., Chicago, is featured in this month's Who's Who. A review of Mr. Bastian's accomplishments since landing in America as a 19 year-old immigrant in 1880 reads like Horatio Alger. He has worked on a farm, been secretary and bookkeeper for a firm, a draftsman and the owner of several manufacturing concerns. Many patents on regulators, cylinder valves and other welding equipment are held by Mr. Bastian.

—30 YEARS AGO—

FOR SHIELDING the oxyacetylene weldor's eyes a new device consists of a square tinted glass and a holder for it mounted right on the torch.

—30 YEARS AGO—

MORE bad news about welding of boilers is contained in the latest report of the Chief Inspector of the Bureau of Locomotive Inspectors. The editor of THE WELDING ENGINEER again reminds readers that unless the welding industry sees to it that only properly qualified welders do this class of work, welding will receive more black eyes.

—30 YEARS AGO—

RECENT repairs made on the Wade Point Lighthouse foundation in Albemarle Sound, N. C., by thermit welding is related in this issue. Huge ice floes in the winter of 1917-18 broke and otherwise damaged the five cast iron columns supporting the structure in 9 ft. of water. A small steamer for carrying the welding material and the necessary workmen was anchored to the lighthouse for three weeks while the job was finished. More than 750 lb of thermit mixture were used.

—30 YEARS AGO—

HARRISON BIRD, for the past five years connected with the Chicago branch of the Davis-Bournonville Co., has been appointed district sales manager at Detroit.

—30 YEARS AGO—

A WELDED 1,000-gal. tank on an oil truck recently held the chassis together when one of the truck's 6-in. channel side-frame members broke in two. The strength and rigidity of the tank enabled the truck to be driven to a body repair shop under its own power.

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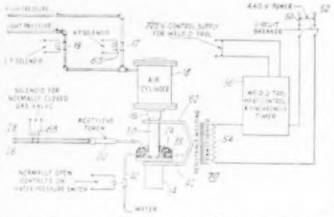
From the Patent Office

Welding Apparatus

2,480,863. Howard J. Kerr, Westfield, N. J., Otis R. Carpenter and Frank W. Armstrong, Jr., Barberton, and Nicholas C. Jessen, Akron, O. Assigned to The Babcock & Wilcox Co., Rockleigh, N. J. Original application March 21, 1944. Divided and this application, March 27, 1946. Granted Sept. 6, 1949.

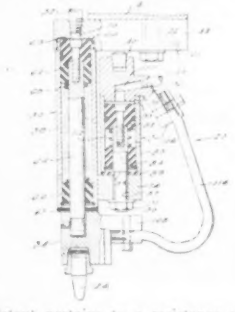


Patent pertains to a welding apparatus where a workpiece holder maintains a number of workpieces in operative relationship and under converging pressures. A fuel burner is disposed around those parts of the held workpieces within the weld zone for preheating purposes. Resistance welding current is applied to the workpieces while the fuel burner remains in its operative position. The converging pressure on the two workpieces is increased during the application of welding current.

* * *

Welding Mechanism

2,481,844. Frederick H. Johnson, Pleasant Ridge, Mich. Filed Nov. 18, 1946. Granted Sept. 13, 1949.



Patent pertains to a resistance welding mechanism which has an electrode positioning device supported on the frame of the welder. A current carrying member is positioned next to the positioning device on which is mounted an electrical circuit controlling apparatus. The controlling means is engageable with the conducting member to complete an electrical circuit. The current goes to the electrode from the circuit controller.

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Arc Welder

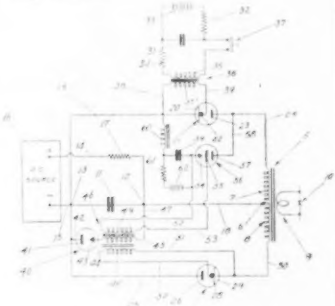
2,478,636. Everett F. Potter, Schenectady, N. Y. Assigned to General Electric Co., Schenectady. Filed Dec. 26, 1947. Granted Aug. 9, 1949.

Apparatus for automatically welding stick electrodes comprises a number of holders and means for supplying current to them. Provision is made for alternately feeding the holders along a common path and in alignment with one another. When the electrode in one holder is substantially consumed it is withdrawn and simultaneously another is fed to the work in another holder. When the withdrawn holder reaches a certain distance from the work it moves out of the path of travel of the new holder. After the holders have passed one another the withdrawn one moves into loading position in line with the holder doing the welding.

* * *

Condenser Welding System

2,477,622. Hans Klemperer, Belmont, Mass. Assigned to Raytheon Mfg. Co., Newton, Mass. Filed May 1, 1945. Granted Aug. 2, 1949.



Recently patented condenser welding system includes a capacitor and charging means, a welding load circuit, means for discharging the capacitor through the welding load with a one-way pulse of current and means for recharging the capacitor with its original polarity by the energy stored in the system as a result of the current pulse. Operable upon the occasion when the stored energy tends to reverse the initial polarity of the capacitor, certain means simultaneously render the second-named means inoperative and the said third-named means operative.

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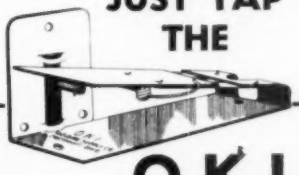

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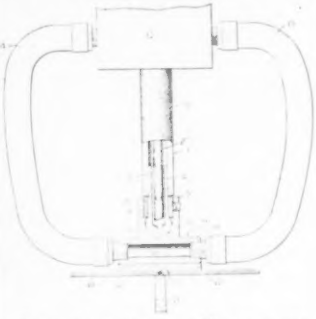
Adjustable R-W Tip

2,479,547. Clarence F. Wersler and Joseph F. Bukowski, Philadelphia, Pa. Assigned to The Budd Co., Philadelphia. Filed Oct. 2, 1946. Granted Aug. 16, 1949.

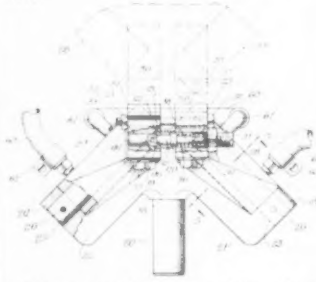


Patent for resistance welding apparatus pertains to a tubular holder, a tip having a work-engaging surface and coolant coupling, and coupling means for establishing a universal joint between the holder and tip. The coupling means comprises a shaft fixed to the holder. A curved head fixed to the shaft is adapted to engage a recess formed in the tip having a cooperating interior surface curvature. An aperture is formed through the head at right angles to the holder axis. A pin is fixed to the tip and penetrates the head aperture, diameter of said aperture being greater than that of the pin.

* * *

Welding Clamp

2,477,319. Lloyd Talbot, Chicago, Ill. Assigned to Robert H. Hoffman, Chicago. Filed Aug. 15, 1946. Granted July 26, 1949.



Patent pertains to a welding clamp which has a shank formed integrally with the body. Outwardly projecting arms form part of the body and are on opposite sides of the base of the shank. Outwardly projecting lugs are at the outer and inner ends of the arms. Huge pins are mounted in and through the lugs. A jaw pivoted on each of the hinge pins is adapted to swing in alignment with each other. Springs hold the free ends of the jaws in yieldable relation for placing work therein. A copper face plate is mounted on the jaws at its forward end. A face plate having transverse serrations on its outer end is mounted on the other jaw member. The latter face is insulated from its jaw. Guiding means direct the movement of both jaws convergingly into close proximity.

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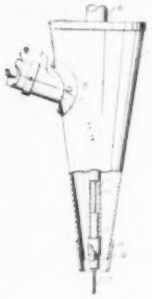
Welding Gun Adapter

2,478,525. JOHN P. CUTRER, Houston, Tex. Assigned to Reed Roller Bit Co., Houston, Tex. Filed Dec. 15, 1947. Granted Aug. 9, 1949.



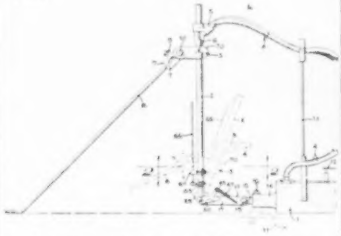
This patent pertains to metal arc welding with a continuous electrode. The electrode rod holder includes a tubular conduit assembly comprised of an outer protective tubing and an inner rod-holding tube extending through the protective shield though ending just short of one of its ends. A tubular block is secured to the end of the outer tubing and has a reduced shank insertable within the bore of the outer tubing and adapted to about the end of the inner rod-holding tube. The block has the upper end of its bore substantially the same diameter as the bore of the rod holding tube.

A tip element is connected by threads to the block and has an axial bore communicating and aligned with the upper portion of the bore of the block. This bore is the same diameter as the upper portion of the block bore so that when the element is in connected position the bores of tip, block and tube formed a continuous passage. Thus an electrode can extend through all three and may project outwardly in advance of the latter.

• • •

Semiautomatic Welder

2,481,163. PAUL H. SETZLER, Hamilton, O. Filed Sept. 11, 1948. Granted Sept. 6, 1949.



Patent pertains to a welding apparatus comprising a base, a post supported from the base and an electrode holder slidably mounted upon the post. The holder is adapted to hold the electrode at an angle to the post with the opposite end upon the work. The descent of the holder is regulated in accordance with the rate of deposition of welding metal. At a predetermined point in the descent the holder and post swing the attached electrode away from the work surface.

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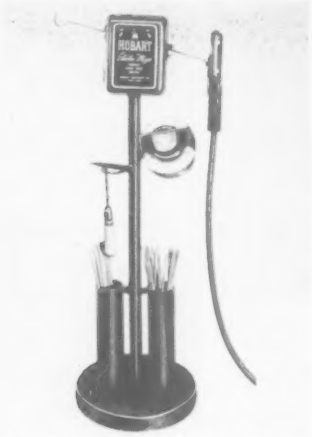
(Continued from page 46)



WEIGHT of electrode holder on start-stop switch shuts off motor-generator welder

Start-Stop Switch

THE "Electro-Mizer" is a remote start-stop switch mounted on a stand. The arms provide finger-touch control and the weight of an electrode holder is sufficient to break the circuit and shut off the welding machine. It works like this: when weldors hangs up the electrode holder, it automatically shuts off the arc welder, and when he again picks up the holder, machine starts automatically. Thus the machine only runs when welding is being done.

The "Electro-Mizer" can be connected to any motor-generator welder having push button starting. In addition to the electrode holder, it provides a convenient place for a remote-control rheostat, electrodes, chipping hammer and wire brush (see picture).

THE HOBART BROTHERS CO., Troy, O.

* * *

X-Ray Film Drier

NEW high-output X-ray film-drying machine that dries from 40 to 200% more films per day than do models of earlier design is known as the "Circulair" drier. The single "Circulair" will completely dry 150 films a day at 86% humidity or 180 at 38% humidity. Efficiency of the drier is due to the fact that intake and exhaust are decreased and the air is recirculated many times to utilize its maximum absorption.

GENERAL ELECTRIC X-RAY CORP., 4855 Electric Ave., Milwaukee 14.

* * *

Tin-Bismuth Alloy

"CERROCAST" is a low-melting alloy of bismuth and tin suitable for precision casting (lost wax method), for use in spray guns and for low-temperature soldering of pretinned metal parts. Its melting range is between 281 and 338 F. Other physical properties include a weight of 0.296 lb per cu. in., Brinell hardness of 22.

CERRO DE PASCO COPPER CORP., New York City.

PRECISION line-up of clutch collar faces achieved with new work-holding device

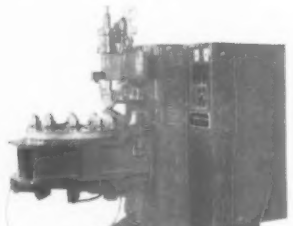
Work-Holding Tool

A NEW work-holding device called "IN-R-TOOL" can be used in welding, machining, assembly and other operations. Primarily an expanding arbor, it has cores and pressure members that are interchangeable to precision dimensions.

The tractor clutch collar in the above illustration is being held by an "IN-R-TOOL" for a welding operation. The collar had been sawed into two parts so that a ¾-in. intermediate section could be inserted and welded. To insure that the bolt holes would be in alignment with the face of the collar, extra-length internal pressure members for the "IN-R-TOOL" were inserted inside the collar. After welding, claims manufacturer, the alignment was so true that only a few thousandths had to be machined off. In other welding operations, it is possible to utilize copper sheet stock to shield the holding tool.

LAYNE-HELD CORP., 2007-P South Shelby St., Higginsville, Mo.

* * *



HIGH RATE of production on motor housings achieved by using rotary indexing table

Dial-Feed on Welder

BY USING a ten-station indexing table on a resistance-welder, parts for an electric motor are welded at the rate of 2,000 per hour. The ratchet-actuated table is synchronized with the weldor. Shaped mandrels mounted on the table serve as loading fixtures. Most of the feeding of parts is by hopper, but where this is not possible two operators take over.

SCIAKY BROS., INC., 4915 West 67th St., Chicago.

Fluxless Aluminum Rod

A LOW-temperature aluminum rod that may be used without any flux is offered for the gas welding of aluminum alloys. Fusion point of "Al-Rod" is 720 F and proper application temperature is 730 to 750 F. "It works like a solder," states manufacturer. Yet tests show a tensile strength of 75,000 psi and a bending moment of 65%.

For materials such as bars and castings, maker recommends heating the parent material to 720 F and tinning with "Al-Rod" which is then used as a filler rod at a slightly higher temperature. Rod is 3/16 in. in diameter and comes in lengths of 18 3/16 in., eight rods to the pound, 5 lb per mailing tube.

THE "AL-ROD" CO., 2136 Mallory St., San Bernardino, Calif.

* * *

Nickel-Silver Rod

AN ALL-PURPOSE flux-coated nickel-silver brazing rod designated as All-State No. 11 is applied with an oxyacetylene torch. Field tests on 14 different metals have indicated its selection where bronze rod is normally considered, says the manufacturer. Tensile and shear strengths of the joint are claimed to be 85,000 and 160,000 psi, respectively. Other desirable properties are the absence of fuming and glare. The flux is said to bend with the rod rather than flake off. In addition, the rod will not bare itself by excessive charring of the flux coating.

ALL-STATE WELDING ALLOYS CO., INC., 273 Ferris Ave., White Plains, N. Y.

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A-C motor starters and contactors with straight-line guided motion of armature and movable contact assembly are said to provide long life and easy maintenance. Coil removal is managed with a screw driver. SQUARE D CO., INDUSTRIAL CONTROLLER DIVISION, 4041 North Richards St., Milwaukee 12.

* * *

Industrial microscope with a self-light source and reticle has been developed to sell at low-cost. Magnifications of either 20 or 40 are available with reticle divisions of 0.002 or 0.004 in. respectively. CLARKSTAN CORP., 11927 West Pico Blvd., Los Angeles 34.

* * *

Hubless metal wheel for materials handling trucks carries a semipneumatic tire suitable for heavy-duty hauling. Hubless feature is claimed to save on damage in warehouses, on loading docks, etc. Four screws hold wheel together. MARKWARDT MFG. CO., 3354 No. Buffum St., Milwaukee.

* * *

Self-locking set screw and adjust screw is designed for parts subjected to heavy vibration. Combination of interference fit, tension and locking of the screw is used. Available in all metals with any type of head. SET SCREW & MFG. CO., Bartlett, Ill.

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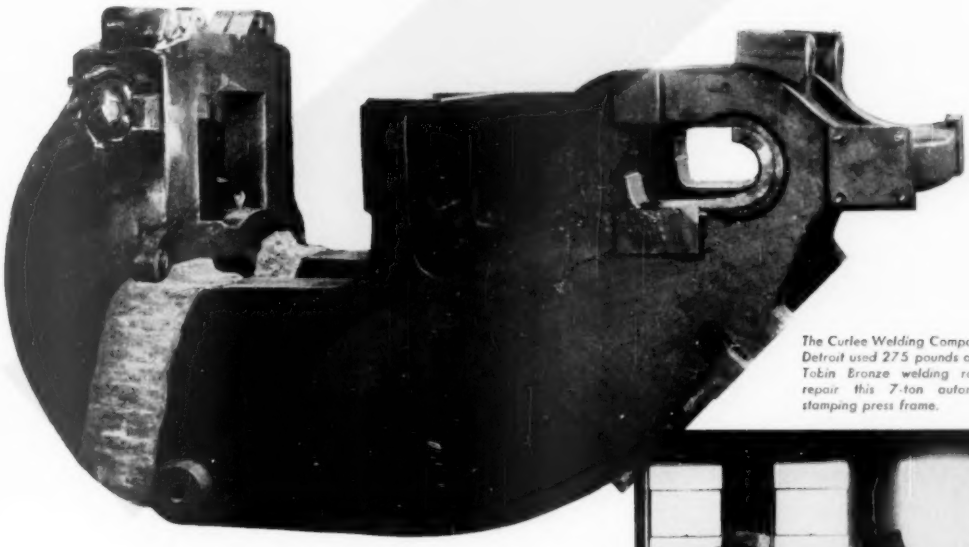
Give the "break" to TOBIN BRONZE

and get a weld you can forget



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